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EVANSIA

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Mosses from the State of Maine - V.

Bruce Allen[1]

Five mosses, *Grimmia affinis*, *Orthotrichum ohioense*, *Thelia hirtella*, *Cryto-hypnum minutulum* and *Sematophyllum demissum*, are reported for the first time from the state of Maine. Previous reports of *Cynodontium suecicum*, *Orthotrichum affine*, *Entodon brevisetus*, and *Anoectangium aestivum* from the state are based on misdeterminations. Unless otherwise noted all collections cited are deposited at MO. The localities for collections made by B. Allen are given below.

Allen 9205-9219: Boothbay Harbor Township, Spruce Point, ca 1.5 mi SE of Boothbay Harbor.
Allen 9220-9258: Jefferson Township, Travel Brook, ca 1 mi NE of Coopers Mill's.
Allen 9269-9360: Moxie Gore Township, Moxie Falls, ca 3 mi NE of The Forks.
Allen 9361-9382: Caratunk Township, Pleasant Pond stream, between Caratunk & Pleasant Pond.
Allen 9383-9427: Carrying Place Township, along Pierce Pond Stream, near Caratunk.
Allen 9428-9438: Forks Plantation, summit Pleasant Pond Mountain, Pleasant Pond.

ANDREAEACEAE

Andreaea crassinervia - **Oxford**: Hebron, Streaked Mountain, J. A. Allen s.n. (MO, UWSP).

A. rupestris Hedw. - **Aroostook**: Bald Mountain, DuMond 2 (UWSP); **Somerset**: Allen 9379.

AMBLYSTEGIACEAE

Amblystegium varium (Hedw.) Lindb. - **Waldo**: Searsmont, Slack 89367.

Calliergon cordifolium (Hedw.) Kindb. - **Hancock**: Southwest Harbor, Bowers 10093 (UWSP); **Somerset**: Allen 9406.

C. stramineum (Brid.) Kindb. - **Hancock**: Southwest Harbor, Bowers 10089 (UWSP); **Somerset**: Allen 9296B.

Campylium chrysophyllum (Brid.) J. Lange - **Somerset**: Allen 9292.

C. polygamum (B.S.G.) C. Jens. - **Somerset**: Allen 9375.

C. stellatum (Hedw.) C. Jens. - **Somerset**: Allen 9402.

Drepanocladus aduncus (Hedw.) Warnst. - **Oxford**: Buckfield, Allen s.n. (UWSP); **Somerset**: Allen 9324A.

Hygroamblystegium tenax (Hedw.) Jenn. - **Somerset**: Allen 9350B.

Hygrohypnum luridum (Hedw.) Jenn. - **Somerset**: Allen 9274.

H. closteri (Aust.) Grout - **Cumberland**: North Bridgton, Wilson s.n. (NY).

H. eugyrium (B.S.G.) Loeske - **Somerset**: Allen 9366.

H. ochraceum (Turn. ex. Wils.) Loeske - **Lincoln**: Monhegan Island, Slack 89327.

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Leptodictyon riparium (Hedw.) Warnst. - **Somerset**: Allen 9294B.

Warnstorfia fluitans (Hedw.) Loeske - **Hancock**: Southwest Harbor, Bowers 10093A (UWSP); **Somerset**: Allen 9342A.

ANOMODONTACEAE

Anomodon attenuatus (Hedw.) Hüb. - **Lincoln**: Allen 9255; **Somerset**: Allen 9295.

A. rostratus (Hedw.) Schimp. - **Somerset**: Allen 9327.

A. rugelii (C. Müll.) Keissl. - **Somerset**: Allen 9293.

AULACOMNIACEAE

Aulacomnium palustre (Hedw.) Schwaegr. - **Somerset**: Allen 9345; **Waldo**: Searsmont, Slack 89352.

A. turgidum (Wahlenb.) Schwaegr. - **Piscataquis**: Mt. Ktaadn, Merrill 52 (NY).

BARTRAMIACEAE

Bartramia pomiformis Hedw. - **Somerset**: Allen 9297.

Philonotis fontana (Hedw.) Brid. - **Somerset**: Allen 9349A.

BRACHYTHECIACEAE

Brachythecium calcareum Kindb. - **Lincoln**: Linekin Bay, Allen 9259A; **Somerset**: Allen 9340.

B. diagastrum C. Müll. & Kindb. in Mac. & Kindb. - **Oxford**: North Hartford, Adams 13473 (NY).

B. oxycladon (Brid.) Jaeg. & Sauerb. - **Somerset**: Allen 9321.

B. plumosum (Hedw.) B.S.G. - **Lincoln**: Allen 9224; **Oxford**: Streaked Mountain, Hebron, Allen s.n. (UWSP); **Somerset**: Allen 9280.

B. reflexum (Starke ex. Web. & Mohr) BSG - **Lincoln**: Allen 9241; **Washington**: Dyers Bay, Dixon s.n. (MICH).

B. rivulare B.S.G. - **Waldo**: Searsmont, Slack 89365.

B. rutabulum (Hedw.) B.S.G. - **Piscataquis**: Baxter State Park, Merello 31; **Waldo**: Searsmont, Slack 89361.

B. salebrosum (Web. & Mohr) B.S.G. - **Somerset**: Allen 9381; **Waldo**: Searsmont, Slack 89364.

B. velutinum (Hedw.) B.S.G. - **Somerset**: Allen 9304.

Bryhnia graminicolor (Brid.) Grout - **Oxford**: 25 Aug., 1932, Parlin 11844 (NY).

B. novae-angliae (Sull. & Lesq. ex Sull.) Grout - **Oxford**: Mt. Buckfield, Allen s.n. (UWSP); **Somerset**: Allen 9396; **Waldo**: Searsmont, Slack 89370.

Eurhynchium pulchellum (Hedw.) Jenn. - **Lincoln**: Allen 9218; **Somerset**: Allen 9399.

Homalotheciella subcapillata (Hedw.) Broth. - **Oxford**: Hebron, Allen s.n. (NY).

Platyhypnidium riparioides (Hedw.) Dix. - **Somerset**: Allen 9331.

BRYACEAE

Bryum caespiticium Hedw. - **Somerset**: Allen 9287B.

B. capillare Hedw. - **Somerset**: Allen 9430.

B. pallens (Brid.) Sw. ex Roehl. - **Oxford**: Buckfield, Parlin s.n. (NY). This specimen was originally reported by Parlin (1939) as *Bryum weigellii*.

B. pseudotriquetrum (Hedw.) Gaertn., Meyer & Scherb. - **Oxford**: North Hartford, Parlin 11662 (NY).

B. weigelii Spreng. - **Oxford**: Norway, Bacon 391 (NY); **Piscataquis**: Moosehead Lake, Greenville, Faxon 259 (NY).

Pohlia cruda (Hedw.) Lindb. - **Somerset**: Allen 9353.

P. elongata Hedw. - **Somerset**: Mt. Bigelow, Collins 1520 (NY).

P. nutans (Hedw.) Lindb. - **Somerset**: Allen 9361.

Rhodobryum ontariense (Kindb.) Par. in Kindb. - **Somerset**: Allen 9336.

BUXBAUMIACEAE

Diphyscium foliosum (Hedw.) Mohr - **Somerset**: Allen 9380.

CLIMACIACEAE

Climacium americanum Brid. - **Somerset**: Allen 9334.

C. dendroides (Hedw.) Web. & Mohr - **Waldo**: Searsmont, Slack 89347.

DICRANACEAE

Cynodontium alpestre (Wahlenb.) Milde - **Somerset**: Mt. Bigelow, Collins 1491 (NY).

C. schistii (Web. & Mohr) Lindb. - **Piscataquis**: Mt. Ktaadn, Norton s.n. (NY).

** *C. suecicum* (Lindb. & Arn.) Par. - Parlin (1939) reported this moss from Oxford County (Hartford, 1930 Parlin and Mexico, 1933 Parlin). These collections in NY represent *Dicranum montanum*.

Dichodontium pellucidum (Hedw.) Schimp. - **Somerset**: Allen 9393.

Dicranella cerviculata (Hedw.) Schimp. - **Oxford**: Grafton, Adams s.n. (MO, NY).

D. subulata (Hedw.) Schimp. - **Oxford**: Sumner, Parlin s.n. (NY), Stoneham, Bacon 547 (NY).

Dicranoweisia crispula (Hedw.) Lindb. *ex* Milde - **Piscataquis**: south basin Mt. Katahdin, Collins s.n..

Dicranum elongatum Schleich. ex Schwaegr. - **Somerset**: Allen 9403.

D. flagellare Hedw. - **Hancock**: Southwest Harbor, Bowers 10075b (UWSP); **Somerset**: Allen 9401.

D. fulvum Hook. - **Somerset**: Allen 9374.

D. fuscescens Turn. - **Aroostook**: Bald Mountain, DuMond 10 (UWSP); **Cumberland**: Cundys Harbor, Davis 169; **Somerset**: Allen 9272.

D. montanum Hedw. - **Hancock**: Southwest Harbor, Bowers 10075a (UWSP); **Oxford**: Hartford, Parlin (NY); **Somerset**: Allen 9315; **Waldo**: Searsmont, Slack 89355.

D. ontariense Peterson - **Somerset**: Allen 9387.

D. polysetum Sw. - **Aroostook**: Bald Mountain, DuMond 7 (UWSP); **Somerset**: Allen 9365; **Waldo**: Searsmont, Slack 89339.

D. scoparium Hedw. - **Aroostook**: Bald Mountain, DuMond 11 (UWSP); **Waldo**: Searsmont, Slack 89341, Stockton Springs, Merello 21.

D. undulatum Brid. - **Hancock**: Southwest Harbor, Bowers 11094 (UWSP); **Somerset**: Allen 9435; **Washington**: 10 mi SE of Machias, Bowers 10159 (UWSP).

D. viride (Sull. & Lesq. ex Sull.) Lindb. - **Somerset**: Allen 9310.

Kiaeria blyttii (Schimp.) Broth. - **Penoboscot**: Millinocket, Hermann 19603 (NY).

Leucobryum glaucum (Hedw.) Ångstr. ex Fr. - **Piscataquis**: Baxter State Park, Merello 27; **Somerset**: Allen 9370; **Waldo**: Searsmont, Slack 89338.

Oncophorus wahlenbergii Brid. - **Somerset**: Allen 9333.

Paraleucobryum longifolium (Hedw.) Loeske - **Somerset**: Allen 9269.

Rhabdoweisia crispata (With.) Lindb. - **Somerset**: Allen 9408.

DITRICHACEAE

Ceratodon purpureus (Hedw.) Brid. - **Penobscot**: Alton, Ogden & Curtis 2516.

Ditrichum lineare (Sw.) Lindb. - **Lincoln**: Allen 9209.

Saelania glaucescens (Hedw.) Bomanss. & Broth. - **Somerset**: Allen 9286.

ENTODONTACEAE

** *Entodon brevisetus* (Hook. & Wils. ex Wils.) Lindb. Listed from Oxford county by Parlin (1939). The report was based on a collection made by C. D. Adams in Hartford in 1938 and issued by Grout (North American Musci Perfecti 334). This collection in MO represents *E. cladorrhizans*. A collection in NY named *E. brevisetus* (N. Hartford, 27 July 1936, Parlin 13017) by R. S. Williams is actually *Pylaisiella polyantha* (Hedw.) Grout.

E. cladorrhizans (Hedw.) C. Müll. - **Oxford**: Hartford, Adams (North American Musci Perfecti 334 in MO).

FISSIDENTACEAE

Fissidens adiantoides Hedw. - **Somerset**: Allen 9281.

F. bryoides Hedw. - **Somerset**: Allen 9412.

F. dubius P.-Beauv. - **Somerset**: Allen 9302.

F. osmundioides - **Somerset**: Allen 9391A.

FONTINALACEAE

Dichelyma capillaceum - **Lincoln**: Allen 9226B.

D. falcatum (Hedw.) Myr. - **Androscoggin**: Livermore, Adams s.n., [Grout N.Am.M.Perf. 375] (NY); **Franklin**: Round Mountain Lake, Lorenz s.n. (NY); **Oxford**: Mt. Pleasant, Denmark, Bailey s.n. (NY); **Piscataquis**: Moosehead, Dunham s.n. (NY, UWSP).

Fontinalis antipyretica Hedw. var. *oreganensis* Ren. & Card. - **York**: West Newfield, Robertson 325.

F. dalecarlica Schimp ex B.S.G. - **Somerset**: Allen 9413.

F. novae-angliae Sull. - **Somerset**: Allen 9415.

F. sphagnifolia (C. Müll.) Wijk & Marg. form aestivalis - **Lincoln**: Monhegan Island, Slack 89326.

F. sullivantii Lindb. - **Lincoln**: Allen 9226.

GRIMMIACEAE

Coscinodon cribrosa Hedw. - **Oxford**: Roxbury, Adams 13249 (NY).

Grimmia affinis Hoppe & Hornsch. ex Hornsch. - **Hancock**: Thunder Hole, Acadia National Park, Wynne 101 (NY).

Racomitrium aciculare (Hedw.) Brid. - **Somerset**: Allen 9343.

R. canescens (Hedw.) Brid. - **Hancock**: Mt. Desert Island, Patterson 687e (NY).

R. microcarpon (Hedw.) Brid. - **Aroostook**: Bald Mountain, DuMond 1 (UWSP); **Somerset**: Allen 9410.

Schistidium agassizii Sull. & Lesq. in Sull. - **Somerset**: Allen 9299.
S. apocarpum (Hedw.) B.S.G. - **Somerset**: Allen 9307.

HEDWIGIACEAE

Hedwigia ciliata (Hedw.) P.-Beauv. - **Somerset**: Allen 9354.

HELODIACEAE

Helodium paludosum (Sull.) Aust. - **Cumberland**: Harrison, Blake 65 (NY); **York**: Wells, Blake 54 (NY).

HYLOCOMIACEAE

Hylocomiastrum pyrenaicum (Spruce) Fleisch. - **Oxford**: Hebron, Allen s.n. (NY); **Piscataquis**: Schoodic Lake, 13.5 mi N of Milo, Hermann 19642 (NY).
H. umbratum (Hedw.) Fleisch. in Broth. - **Oxford**: Mt. Buckfield, Owl's Head, Allen s.n. (UWSP).
Hylocomium splendens (Hedw.) B.S.G. - **Somerset**: Allen 9285.
Pleurozium schreberi (Brid.) Mitt. - **Somerset**: Allen 9368; **Waldo**: Searsmont, Slack 89344; **Washington**:10 mi SE of Machias, Bowers 10144 (UWSP).
Rhytidiadelphus squarrosus (Hedw.) Warnst. - **Somerset**: Allen 9388; **Waldo**: Searsmont, Slack 89354.
R. triquetrus (Hedw.) Warnst. - **Somerset**: Allen 9279.

HYPNACEAE

Callicladium haldanianum (Grev.) Crum - **Somerset**: Allen 9276; **Waldo**: Searsmont, Slack 89342, 89350.
Herzogiella striatella (Brid.) Iwats. - **Somerset**: Allen 9389.
H. turfacea (Lindb.) Iwats. - **Somerset**: Allen 9351; **Waldo**: Searsmont, Slack 89345, 89356.
Hypnum cupressiforme Hedw. var. *resupinatum* (Wils.) Schimp. - **Lincoln**: Allen 9213.
H. imponens Hedw. - **Somerset**: Allen 9390.
H. lindbergii Mitt. - **Lincoln**: Allen 9250; **Oxford**: Norway, Bacon 400 (NY); **Somerset**: Allen 9339.
H. pallescens (Hedw.) P.-Beauv. - **Somerset**: Allen 9323.
H. pratense Koch ex Brid. - **Somerset**: Allen 9294A.
Isopterygiopsis muelleriana (Schimp.) Iwats. - **Somerset**: Allen 9386.
Platygyrium repens (Brid.) B.S.G. - **Lincoln**: Allen 9227; **Somerset**: Allen 9303A.
Pylaisiadelpha tenuirostris (Bruch & Schimp. ex Sull.) Broth. - **Somerset**: Allen 9434.
Pylaisiella intricata (Hedw.) Grout - **Somerset**: Allen 9427.
P. selwynii (Kindb.) Crum, Steere & Anders. - **Hancock**: Somesville, Rand s.n. (NY).

LESKEACEAE

Lindbergia brachyptera (Mitt.) Kindb. - **Androscoggin**: Turner, Parlin 10553 (NY); **Oxford**: South Hartford, Howard 13198 (NY).

LEUCODONTACEAE

Leucodon brachypus var. andrewsianus Crum & Anderson - **Somerset**: Allen 9301.

MNIACEAE

Cyrtomnium hymenophylloides (Hüb.) Nyh. - **Hancock**: Jordon Bluffs, Mt. Desert

Island, Patterson s.n. (NY); **Somerset**: Allen 9300A.

Mnium hornum Hedw. - **Somerset**: Allen 9288.

M. spinulosum B.S.G. - **Somerset**: Allen 9385.

M. stellare Hedw. - **Lincoln**: Allen 9256B; **Somerset**: Allen 9286B.

M. thomsonii Schimp. - **Somerset**: Allen 9344.

Plagiomnium ciliare (C. Müll.) T. Kop. - **Waldo**: Searsmont, Slack 89368.

P. cuspidatum (Hedw.) T. Kop. - **Somerset**: Allen 9318A.

P. ellipticum (Brid.) T. Kop. - **Lincoln**: Allen 9256A; **Somerset**: Allen 9296A.

P. medium (B.S.G.) T. Kop. - **Somerset**: Allen 9324C.

Pseudobryum cinclidioides (Hüb.) T. Kop. - **Lincoln**: Monhegan Island, Slack 89318; **Somerset**: Parkman Hill, 3.5 mi ESE of Solon, Ladd 8904.

Rhizomnium appalachianum T. Kop. - **Somerset**: Allen 9416.

R. punctatum (Hedw.) T. Kop. - **Lincoln**: Allen 9233; **Waldo**: Searsmont, Slack 89360.

ORTHOTRICHACEAE

Amphidium mougeotii (B.S.G.) Schimp. - **Oxford**: Snow Falls, Paris, Parlin 13605 (NY); **Somerset**: Allen 9289.

** *Orthotrichum affine* Brid. This species was reported from the counties of Hancock (Patterson, 1930) and Oxford (Parlin, 1939). The Patterson collections in NY represent *O. stellatum* (Salisbury Cove, Patterson 426) and *O. sordidum* (Jordon Bluff, Patterson 305, Bar Harbor Patterson 427). The Oxford collection in NY is *O. sordidum* (Hartford, Parlin 12418).

O. ohioense Sull. & Lesq. ex Aust. - **Somerset**: Allen 9364c; **York**: Wells, May 1880, sine coll. (NY).

O. sordidum Sull. & Lesq. ex Aust. - **Oxford**: Hartford, Parlin 12418 (NY); **Piscataquis**: Mt. Ktaadn, Merrill 101 (NY).

O. stellatum Brid. - **Aroostook**: Portage Lake, Richards s.n. (NY).

Ulota coarctata (P.-Beauv.) Hamm. - **Lincoln**: Allen 9225; **Somerset**: Allen 9337.

U. hutchinsiae (Sm.) Hamm. - **Somerset**: Allen 9347.

PLAGIOTHECIACEAE

Plagiothecium cavifolium (Brid.) Iwats. - **Lincoln**: Monhegan Island, Slack 89328; **Somerset**: Allen 9356; **Waldo**: Searsmont, Slack 89351.

P. denticulatum (Hedw.) B.S.G. - **Lincoln**: Allen 9228; **Waldo**: Searsmont, Slack 89346.

POLYTRICHACEAE

Atrichum oerstedianum (C. Müll.) Mitt. - **Somerset**: Allen 9284.

Pogonatum dentatum (Brid.) Brid. - **Piscataquis**: Mt. Katahdin, Hermann 19272 (NY).

Polytrichastrum alpinum (Hedw.) G.L. Sm. - **Somerset**: Allen 9358.

Polytrichum juniperinum Hedw. - **Aroostook**: Bald Mountain, DuMond 4 (UWSP); **Somerset**: Allen 9290B; **Waldo**: Searsmont, Slack 89336.

P. longisetum Brid. - **Franklin**: Middle Dam, Rangeley Lakes, Dunham s.n. (NY). Reported by Dunham (1907) as *Polytrichum gracile*.

P. pallidisetum Funck. - **Piscataquis**: Baxter State Park, Merello 30; **Waldo**: Searsmont, Slack 89837, 89343.

P. piliferum Hedw. - **Aroostook**: Bald Mountain, DuMond 5 (UWSP); **Somerset**: Allen 9400.

P. strictum Brid. - **Somerset**: Allen 9437.

POTTIACEAE

** *Anoectangium aestivum* (Hedw.) Mitt. This moss was reported (as *Anoectangium peckii* Sull.) from Oxford County by Parlin (1939). A duplicate of the Parlin collection in NY is *Amphidium mougeotii* (B.S.G.) Schimp. This is the only report of *A. aestivum* from the state.

Bryoerythrophyllum recurvirostre (Hedw.) Chen - **Somerset**: Allen 9275c.

Gymnostomum aeruginosum Sm. - **Somerset**: Allen 9312A.

Hymenostylium recurvirostrum Hedw. - **Somerset**: Allen 9312B.

Oxystegus tenuirostris (Hook. & Tayl.) Lindb. - **Somerset**: Allen 9322.

Tortella tortuosa (Hedw.) Limpr. - **Somerset**: Allen 9282.

PTERIGYNANDRACEAE

Heterocladium dimorphum (Brid.) B.S.G. - **Oxford**: Hartford, Parlin s.n. (NY).

Myurella julacea (Schwaegr.) B.S.G. - **Hancock**: Jordon Bluffs, Mt. Desert Island, Patterson 309 (NY).

M. sibirica (C. Müll.) Reim. - **Somerset**: Allen 9291A.

Pterigynandrum filiforme Hedw. - **Somerset**: Allen 9346.

SEMATOPHYLLACEAE

Brotherella recurvans (Michx.) Fleisch. - **Lincoln**: Monhegan Island, Slack 89323.

Sematophyllum demissum (Wils.) Mitt. - **Hancock**: Jordon Bluffs, Patterson 291 (NY). This collection reported by Patterson (1930) as *Sematophyllum marylandicum*.

SPLACHNACEAE

Splachnum ampullaceum Hedw. - **Aroostook**: Fort Kent, Mackenzie 3599 (NY); **Franklin**: Round Mountain Lake, Seven Ponds Township, Lorenz s.n. (NY); **Hancock**: North of Long Pond, Mt. Desert Island, White s.n. (NY); **Oxford**: Umbago Lake, Upton, Austin s.n. (NY), Hebron, Stevens s.n. (NY).

Tayloria serrata (Hedw.) B.S.G. - **Franklin**: Grant's Pond, Lorenz s.n. (NY).

Tetraplodon angustatus (Hedw.) B.S.G. - **Franklin**: Upper Dam, Rangeley Lakes, Dunham s.n. (NY).

T. mnioides (Hedw.) B.S.G. - **Hancock**: Prospect Harbor, Northrop 8 (NY).

TETRAPHIDACEAE

Tetraphis pellucida Hedw. - **Somerset**: Allen 9271A; **Waldo**: Stockton Springs, Merello 23.

THELIACEAE

Thelia hirtella (Hedw.) Sull. - **Lincoln**: Allen 9216B.

THUIDIACEAE

Cyrto-hypnum minutulum (Hedw.) Buck & Crum - **Somerset**: Allen 9328.

Rauiella scita (P.-Beauv.) Reim. - **Androscoggin**: Auburn, Merrill 2 (NY); **Oxford**: Hartford, Parlin s.n. (NY); **Penobscot**: South La Grange, Harvey s.n. (NY); **Piscataquis**: Katahdin, Merrill 133 (NY).

Thuidium delicatulum (Hedw.) B.S.G. - **Lincoln**: Monhegan Island, Slack 89306; **Somerset**: Allen 9313; **Waldo**: Searsmont, Slack 89353.

Acknowledgements. I thank the curators of NY and UWSP for the loan of specimens and Nancy Slack for permission to publish on her collections; William Buck helped substantially in ferreting out the literature, provided working space at NY and supplied numerous Maine moss records.

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Patterson, P.M. 1930. The mosses of Mount Desert Island Maine. *The Bryologist* 33: 83-89.

Eagle Hill Wildlife Research Station

Advanced Field Seminars on the Maine Coast in Summer, 1991

Lichens - with Sharon P. Gowan, June 23-29

Bryophytes of Maine - with Howard Crum, September 8-14

Peatland Reclamation and Restoration - with Norman Famous, September 15-21

For more information write to Eagle Hill Wildlife Research Station, Steuben, Maine 04680 or call 207-546-2821 or 718-622-0452.

Are Lichens Edible?

Phillip D. Moore & Robert S. Egan[1]

Introduction. The most obvious indication that a plant is edible is documentation that the plant has been eaten. However, historical use of a plant should not be considered an adequate criterion for edibility. **Ideally, toxic, allergenic, and bitter tasting substances should be absent from an edible species. Additionally, the product should contain some digestible substances of nutritional value.** A particular plant part may not meet these criteria and may still be considered edible when a redeeming characteristic, such as desirable flavor, is present. For example, the small amounts of the spice nutmeg that are normally used for culinary purposes are considered safe. However, larger amounts, six to eight teaspoons or more, are extremely bitter, seriously toxic, and hallucinogenic (Lewis, 1977). Several common foods are potentially poisonous in very large amounts. Onions (*Allium cepa*), lima beans (*Phaseolus lunatus*), and the mustards (*Brassica* spp.) are all potentially toxic (Kingsbury, 1964). Still, toxicity is at least as important a consideration as a history of use.

Lichens in particular need to be reexamined for "edibility." In general, they are thought to be edible and are frequently reported as such. Bradford Angier (1956) in How to Stay Alive in the Woods, says "All Arctic vegetation is edible except for some mushrooms." He quotes Royal Canadian Mounted Police sources: "They [lichens] are edible." During World War II, lichens were recommended as emergency Arctic fare to personnel of the United States Army Air Force (Llano, 1948). These recommendations were qualified by noting that bitter and irritating principles must first be removed.

The genus *Umbilicaria* is sometimes listed as an example of an edible lichen (Medsger, 1939; Angier, 1956; Morton, 1963; Peterson, 1977; Rogers, 1980). Szczawinski and Hardy (1962) wrote, "It is a known fact that species of *Umbilicaria* . . . have been used by Arctic peoples as a well-known source of food." Indeed, many species of *Umbilicaria* have been eaten. *Umbilicaria esculenta* (Miyoshi) Minks is consumed as a delicacy. However, the use of some species does not constitute edibility for the genus. The idea that North American *Umbilicaria* spp. are edible is based in large part upon Sir John Franklin's Arctic expeditions of the 1820's (Llano, 1944, 1948). On these expeditions, and on earlier expeditions by French Canadian trappers, various species, including *U. proboscidea* (L.) Schrad., *U. hyperborea* (Ach.) Ach., and *Lasallia pensylvanica* (Hoffm.) Llano, were employed as

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food during shortages. However, on these same expeditions old bones and hides with the hair singed off were nearly as typical a meal as the "tripe de roche." Moreover, many of these explorers became severely ill following lichen "meals" (Franklin, 1823). The fact that one party ate nothing but lichen for eleven days is testament not so much to the edibility of the lichen as to the extreme hardships endured. The historical accounts of "tripe de roche" by Radisson, Ménard, Allouez, Charlevoix, and Long leave little doubt as to the quality of this "food".

While it is frequently assumed that the Eskimos and northern Indians made great use of lichens as food, such is not the case. Although a few groups of Eskimos of north-central Canada eat, or have eaten, the partly digested lichen from the stomachs of killed caribou and muskoxen as a delicacy, this practice is not common and is evidently unknown among the western Eskimos of Alaska (Llano, 1956). Moreover, out of the great abundance and diversity of lichens in the far north, only *Umbilicaria muhlenbergii* (Ach.) Tuck. is eaten by the native peoples (Franklin, 1823). Llano (1956) points out that most primitive Arctic and Subarctic peoples do not use lichens for food, even under emergency conditions.

Llano documents this "edible lichen" fixation in the popular mind. When assisting in the preparation of a survival manual for the military, he intentionally deleted all references to lichens as emergency food. However, the military authorities considered this an oversight and "very thoughtfully added the unnecessary data" (Llano, 1956).

Poisonous or Toxic Substances. Few lichen are considered poisonous. We found only three species considered to be poisonous, *Letharia vulpina* (L.) Hue., *Tuckermannopsis pinastri* (Scop.) Hale, and *Xanthoparmelia chlorochroa* (Tuck.) Hale. Two of these species, *L. vulpina* and *T. pinastri*, were once used to poison wolves (Smith, 1921; Llano, 1956). The poisonous compound in *L. vulpina* is the lemon-yellow, pulvinic acid derivative vulpinic acid. Synthetic preparations of vulpinic acid and direct extractions of the compound from *L. vulpina* have been shown experimentally to be poisonous to vertebrates (Smith, 1921; Llano, 1948, 1956).

Although other lichens containing vulpinic acid have not been listed as poisonous, in at least one case, vulpinic acid has been cited as a deterrent to edibility. The range of two morphologically similar species of "black tree moss" overlap near the Northwest Coast. *Bryoria fremontii* (Tuck.) Brodo & D. Hawksw. is a montane and inter-montane species, while *Bryoria tortuosa* (G.K. Merr.) Brodo and D. Hawksw. has a more coastal center of distribution (Turner, 1977). Although *B. fremontii* ("*Alectoria jubata*" in earlier ethnobotanical literature) has been an important source of food for several tribes of the Pacific Northwest coast, *B. tortuosa* has been largely ignored as a potential food. Turner (1977) points out the ethnographic significance of the quantities of vulpinic acid in these species. While only occasional thalli of *B. fremontii* contain significant amounts of vulpinic acid, *B. tortuosa* contains relatively large amounts of this substance (Brodo and Hawksworth, 1977). Moreover, the native groups that utilized *B. fremontii* as food were "well aware of the difference between them, at least on the basis of taste" (Turner, 1977).

The poisonous compound in *Tuckermannopsis pinastri* is the golden-yellow medullary substance pinastric acid (Smith, 1921; Llano, 1944, 1948, 1956). Although they are not reported to be poisonous, other lichens, such as *Tuckermannopsis juniperina* (L.) Hale and *Chrysothrix candelaris* (L.) Laundon, contain pinastric acid (Culberson, 1969).

The only lichen species listed in John Kingsbury's "Poisonous Plants of the United States and Canada" (1964) is *Xanthoparmelia chlorochroa* (Tuck.) Hale (listed as *Parmelia molliuscula* Ach.). Experimental evidence showed the toxin to be usnic acid. In feeding experiments with cattle and sheep, it was found that a single dose of 3.6% of an animal's weight, or 1% for five days, was lethal.

Commercial antibiotics containing usnic acid are generally considered to be relatively non-toxic. Usnic acid, along with evernic, physodic, and protolichesterinic acids, have been ingested medicinally in doses of 2-5 grams, apparently without harm (Richardson, 1975). However, since a lichen may contain up to 5% dry weight usnic acid, the equivalent quantity of lichen considered "safe" would be only 40-100 grams (1.4-3.5 ounces).

Other toxic compounds are found in various species. For example, rhizocarpic acid, the pulvinic acid derivative of *Rhizocarpon* spp., is considered poisonous. Potentially dangerous levels of beryllium have been found in *Parmelia saxatilis* (L.) Ach. and *Xanthoria parietina* (L.) Th. Fr. Chlorine has been found in *Pseudevernia furfuracea* (L.) Zopf (Llano, 1944, 1948, 1956).

More recently, experiments with *Cetraria islandica* and *Cladina rangiferina*, species traditionally considered edible, showed both species to be toxic to laboratory mice (Airaksinen et al., 1986). The traditional method of preparing these lichens is to soak them in ash and then boil them before serving or drying for storage. Even after soaking and boiling, *Cladina rangiferina* produced toxic symptoms, dehydration, diarrhea, and bloody urine within three days. The reactions to *Cetraria islandica* were not quite as severe. Mice fed 50% concentrations of untreated Iceland lichen died within 6 days; those fed the treated lichen lived three or four weeks. Even mice fed only a 25% concentration of the treated *C. islandica* over a three month period .pa showed some toxic effects. Analysis indicated that, at least in the case of the 25% concentration, the principle toxic compound is lead from air pollution.

Allergenic Substances. Some people develop allergic reactions to lichens. In a study by Thune and Solberg (1980), of 45 dermatitis patients, 16 showed positive reactions to a mixture of lichens. These sixteen patients were given patch tests of 14 isolated lichenic acids. Seven patients tested positive for sensitivity to atranorin, three to usnic acid, and three to evernic acid. Other immunologically active lichen compounds included stictic acid, fumarprotocetraric acid, lobaric acid, physodic acid, physodalic acid, diffractaic acid, and alantolactone. Similar results were obtained from a subsequent study of seven patients showing allergic reactions to oak moss perfume (Thune et al., 1982).

Taste. In addition to their toxic effects, many lichen substances, such as vulpinic acid and fumarprotocetraric acid, are very bitter (Hale, 1974). It could be hypothesized that the bitterness of vulpinic acid has prevented poisonings by lichens with this substance (see earlier discussion on *Bryoria fremontii*). At least some of these toxic and bitter substances can be removed by boiling. *Cetraria islandica* (L.) Ach., which contains fumarprotocetraric acid, has a fairly extensive history of use, at least in the Northern Hemisphere. In Iceland, this lichen was soaked, usually with lye and boiled, to remove the acid then dried and powdered. The results, called "Iceland Moss," were sold commercially for use as an additive to grain flour, as a thickener for soups, or as gruel (Smith, 1921; Llano, 1944, 1948; Richardson, 1975).

Nutritional Value. Nutrition is another criterion which should be considered in deciding edibility. Vitamins have been identified in lichens, but quantities are quite low (Llano, 1944; Hale, 1974). Proteins are only a minor component of lichen, around five percent dry weight in some cases (Richardson, 1975). The major carbohydrates are the polysaccharides lichenin and isolichenin. Although, several studies with these substances have been made, there are few concrete conclusions concerning digestibility. The ability to digest lichenin into simple sugars may be a characteristic of invertebrates only, but some vertebrates (reindeer for example) have the intestinal aerobic and anaerobic bacteria to metabolize the lichen polysaccharides (Llano, 1944, 1948, 1956). Several researchers indicate that the nutritive value for humans is very low, or none at all (Smith, 1921; Llano, 1948; Richardson, 1975).

Identification. Another question that may be important in determining edibility is whether the current species concepts adequately delimit lichen taxa for separation into edible and non-edible categories. Since many lichen species are treated taxonomically with two or more chemical strains, there exists the possibility that one strain, perhaps an "acid-deficient" strain, may meet some criteria of edibility while another morphologically similar lichen with a different chemistry may not meet the same criteria. However, since many of these chemical strains are now recognized at the specific level, more accurate reference can be made to the possible edibility of various "species." This was not the case when various chemical types were all considered conspecific. For example, "*Alectoria jubata* (L.) Ach." has been used as a "blanket" name for various pendent species of *Bryoria* (Brodo and Hawksworth, 1977). As Turner (1977) points out, the edible "*Alectoria jubata*" that occurs in ethnobotanical literature is *Bryoria fremontii*, and other species of *Bryoria* are probably not edible.

Conclusion. In conclusion, the historical uses of lichens for emergency fare, especially by Arctic explorers, and the obvious ability of reindeer, caribou, and other herbivores to subsist on lichens, has led to overstated generalizations about the edibility of lichens. When individual species are investigated and assessed using commonly accepted standards, a case for edibility for only a very few species can be argued, most notably *Umbilicaria esculenta* and *Bryoria fremontii.* However, all lichen species would very likely fail an "ideal" concept of edibility. **Although, it is frequently said that lichens are edible "in general," a much more reasonable statement is: "in general, lichens are not edible."**

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LICHENOLOGY POSITION (US)

The Department of Botany, National Museum of Natural History, Smithsonian Institution is recruiting for a research curatorial position in lichen systematics. Applicants must have an active research program in monographic and floristic botany documented by publications and presentations. The position will involve both field work and curation of the National Herbarium. Applications filed under the Merit Promotion Announcement number (MPA) 91-2030 must be received by the Office of Human Resources before 31 March 1991. For more information and a position announcement contact: Warren L. Wagner at (202) 786-2517.

1990 Meeting of ABLS at Wakulla Springs, Florida

Janice M. Glime[1]

The 1990 meeting of ABLS was held at Edward Ball Wakulla Springs State Park, Florida. Participants arrived on 27 December and greeted their colleagues at an informal party that evening. The next day we visited several interesting roadside *Sphagnum* areas, where we saw introduced *Dionaea* and looked for *Sphagna* that may have arrived with them (no luck, but during the three days in the field we saw several interesting native taxa, including *S. affine, S. bartlettianum, S. cuspidatum, S. fitzgeraldii, S. lescurii, S. macrophyllum, S. m.* var. *floridanum, S. magellanicum, S. molle, S. perichaetiale, S. portoricense, S. recurvum,* and *S. tenerum*).

The first morning of papers (29 December) concerned ecology. Alison Downing told us there were more bryophytes on limestone substrates than non-limestone ones in Australia and Ann Stoneburner presented the phytogeography of mosses of western Australia. Ken McFarland showed the effects of high water pressure application of a pesticide soap on epiphytic bryophytes in the Smokies, Norton Miller used paleobryology to describe Alaskan refugia, Dale Vitt recommended the use of 3-d response surfaces to present bryological responses to climatic factors and described variation of *Meesia* in a boreal to arctic phosphorus gradient.

That afternoon, topics of polyploidy and ultrastructure in bryophytes were discussed by Bob Wyatt, Barbara Crandall-Stotler, K. Vaughn, Karen Renzaglia, and Doug Bernhard. David Wagner dynamically explained the confusion about right-handed and left-handed spirals as the terminology has been used traditionally in chemistry and physics, versus the way we have used it to describe elaters. During the break I caught Ben Tan with a puzzled look on his face and a screw in his hand.

On the morning of 30 December, we learned about liverworts of Alabama, Alaska, and Panama from Steve Timme, Paul Davison, and Ray Stotler, respectively. Bruce Ryan described baseline studies on lichens to be used to monitor air pollution in California, and we learned from Roger Rosentreter that the northern flying squirrel is a connoisseur of certain lichens, storing them as preferred winter food. Ernie Brodo convinced us that professional photographers (Sylvia and Steve Scharnoff) can help us to educate the public about lichens. Walter Judd gave a special lecture on the vegetation and flora of Florida.

The afternoon included various approaches to systematics, including Brent Mishler on integration of both molecular and morphological data for reconstructing phylogenies,

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Greg Derda on genetic similarity in *Polytrichum*, and Dana Griffin on *Breutelia*. Bruce Allen concluded that *Fontinalis* is the most difficult genus he has ever studied and presented a new key to its North American species. Brent Mishler was kind enough to provide two evening workshops on cladistic methods for us.

The most exciting presentation for most of us was the find of the *Takakia* sporophyte in the Aleutians. Ken McFarland (co-authored by David Smith and Paul Davison) presented beautiful photographs of a single-valved spirally opening capsule, with compelling evidence that *Takakia* belongs in the Andreaeopsida, most closely related to *Andreaeobryum*. This presentation came one day after Barbara Crandall-Stotler presented developmental evidence that *Takakia* differs from other bryophytes studied, including *Haplomitrium, Andreaeobryum, Andreaea, Sphagnum,* and *Tetraphis,* in having monoplastidic meristematic cells. Discussion after McFarland's presentation ended all too quickly. Lewis Anderson announced that he felt the discovery presented by McFarland's group was the most significant one ever presented at a bryological meeting. We were pleased that Jack Sharp, who was the first to find *Takakia* in the Aleutians, was there to join in the excitement.

At the business meeting on 31 December, Wendy Zomlefer, who is Dana Griffin's student at the Florida Museum of Natural History in Gainesville, and Efrain DeLuna, who is Brent Mishler's student at Duke University in Durham, received awards for the best student papers. Wendy had presented her work on the tropical genus *Rigodium*, suggesting its relationship to either Thuidiaceae or Leskeaceae. Efrain had presented a phylogenetic circumscription of the Hedwigiaceae, stressing the problems underlying choice of appropriate outgroups for cladistic analysis.

We voted to raise subscriptions to The Bryologist by $10 in 1992 and the executive committee announced that now members can subscribe to either *The Bryologist* or to *Evansia* or **to both**. Hopefully this division will permit more non-professional people with interests in bryophytes to join the society.

Bill Buck had kindly planned a New Year's Eve party for us, and until 11:55 p.m. observers could see a circle of lichenologists sitting and discussing the format of a beginner's book on lichens and the establishment of a 35 mm slide collection to be available for purchase, while most bryologists sat in a second circle discussing the significance of the presentation on *Takakia*. Just prior to midnight we went outside to observe the blue moon and offer our silent prayers for peace in the new year.

We spent most of 31 December and 1 January on our knees searching for ephemerals and other minutia along roadsides and in *Taxodium* swamps. Our efforts were rewarded by *Archidium alternifolium, A. hallii, A. ohioense, Brachymenium klotzschii, Bruchia flexuosa, Eccremidium floridanum, Ephemerum crassinervium, E. c.* var.

taxanum, E. serrulatum, Micromitrium megalasporum, and *Pleuridium ravenelii.* Attention to so many wonderful details were greatly appreciated by all. Wendy Zomlefer had prepared moss and lichen T-shirts. Dick Harris wrote a book, "Some Florida Lichens." Coffee and lunch breaks giving us abundant time to talk to colleagues. Bill Buck and Bruce Allen planned and orchestrated a very relaxed and enjoyable meeting, and to them and all those helping to make the field trips true learning experiences we owe a debt of gratitude.

Eighth Midwest Bryological & Lichenological Foray

Bruce Allen[1]

The Eighth Midwest Bryological & Lichenological Foray was held September 21-22, 1990 on the Missouri Ozark Plateau. The foray, organized by Paul Redfearn and Bruce Allen, was based at Big Springs in the Ozark National Scenic Riverways. Localities in Shannon and Carter counties were visited and included dolomite limestone outcrops, rhyolite glades, Big Spring (one of the two largest single-outlet springs in the United States), Big Spring branch and a granite quarry. Twenty-six people from nine states attended the foray: *New York* - William R. Buck and Richard Harris; *North Carolina* - Lewis Anderson and Pat Anderson; *Ohio* - Jerry Snider and Si He; *Illinois* - Malcolm Sargent and Ann Sargent; *Michigan* - Janice Glime, Yenhung Li, Jinkun Zhang, and Chang-liang Liao; *Minnesota* - William Norris; *Iowa* - Cynthia Dassler; *Missouri* - Robert Magill, Jenny Magill, Paul Redfearn, Alice Redfearn, Robin Moran, Cirri Rohrbach, Willard Walker, Patsy Walker, Tzen Yuh Chiang, Martha Allen and Bruce Allen; and *Kansas* - Steve Timme. The weather was splendid. The foray organizers wish to acknowledge and thank James Simpson and Alex Outlaw of the National Park Service, Ozark National Scenic Riverways for arranging permission to collect within the park boundaries.

Those who attended the foray can obtain a color photograph of the group by either sending a list of the bryophytes and/or lichens they collected (Xerox the pertinent pages in your field book) or $2.00 to me.

The Ninth Midwest Bryological & Lichenological Foray will be organized by Diana Horton.

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The Distribution of North American Bryophytes The *Sphagnum imbricatum* Russ. Complex

Dale H. Vitt[1] & Robert Gauthier[2]

Sphagnum imbricatum is a member of the Section *Sphagnum*, and in a broad sense is distinguished by equilaterally-triangular green cells that are exposed only on the concave surface of the leaf, and by hyaline cells that have their side walls ornamented by ridge-like comb fibrils. Based on these features, only *S. portoricense* and *S. henryense* can be confused. These species are distinguished by key characters presented in Crum (1984). As early as 1961, Tallis reported on the presence of two morphological extremes of *S. imbricatum*. These 'bog' and 'fen' types were studied by Green in 1968, who suggested that they were ecological modifications of one species. More recently, the species complex was revised by Kjell Flatberg (1984), who recognized five subspecific taxa, of which three occur in North America. Three years later in 1987, Dick Andrus recognized four of these taxa as distinct species. The 'bog' form he considered as *S. austinii* Sull. *in* Aust., using Sullivant's name that was based on specimens collected in New Jersey. The temperate 'fen' form was named *S. affine* Ren. & Card. (from New York), whereas the subarctic-arctic form was named in honor of W. C. Steere (as *S. steerei* Andrus). *Sphagnum imbricatum*, itself, is a species not found in North America, it being restricted to eastern Asia.

The world distribution of *S. imbricatum* (*sensu lato*) was shown by Lid (1925) as including western Europe, eastern Asia, and both the northwestern and eastern coasts of North America. He showed it as a distinctly coastal species. In 1963, Tjuremnov mapped the species for the world, showing localities in Asia, from extreme northeastern Siberia south through northeastern China to Korea and Japan. He mapped its' North American occurrence from Labrador and James Bay (both localities that we have not been able to confirm), south in Newfoundland, the Carolinas, Florida, and Cuba. The distribution of *S. imbricatum*, if considered in a broad sense as did Crum (1986), is shown in figure 1. When divided into three species following Andrus (1987), the patterns are as shown in figure 2. *Sphagnum austinii* is found along the west coast of the continent from Washington state north to southernmost Alaska, and along the east coast from Newfoundland south to New Jersey. This is a species of hummocks in ombrotrophic bogs and other oligotrophic habitats and is confined to maritime areas. Kjell Flatberg (1984) suggested that *S.*

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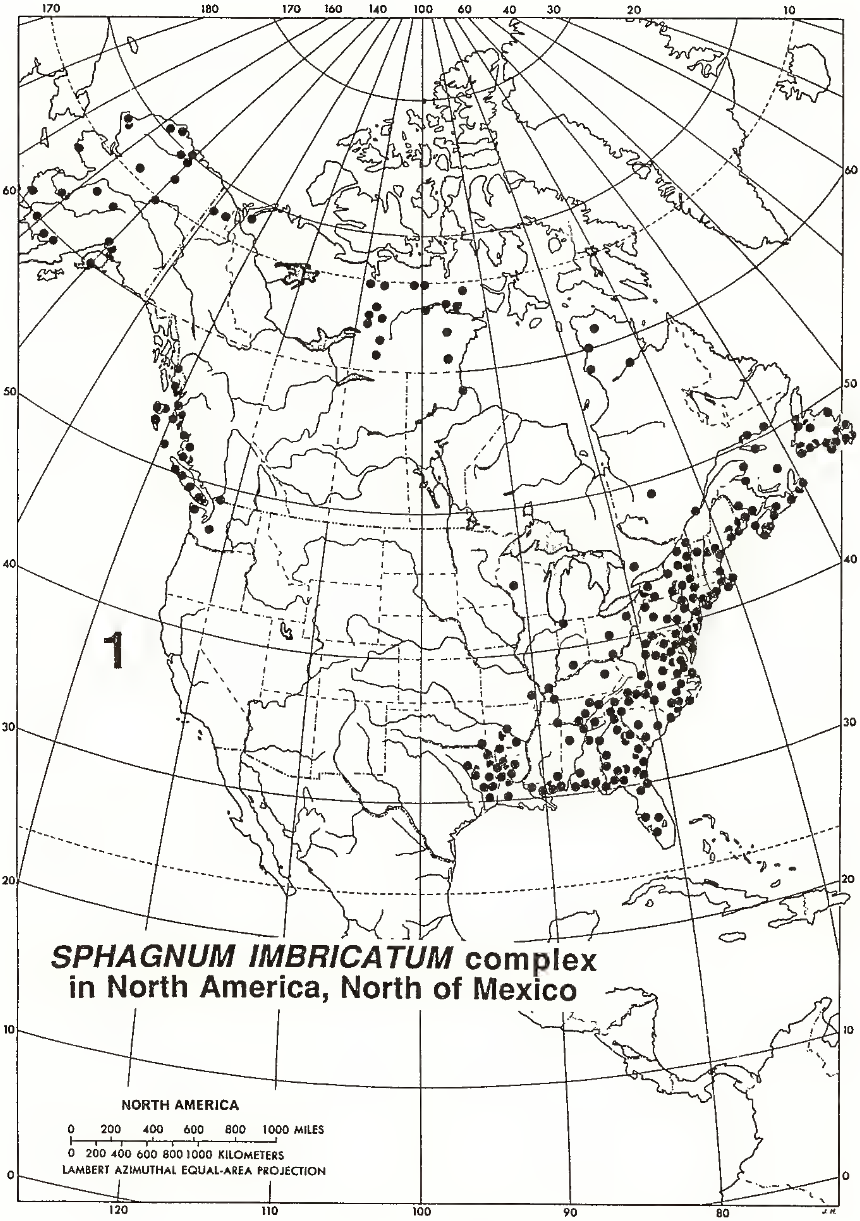
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***SPHAGNUM IMBRICATUM* complex in North America, North of Mexico**

austinii may be limited by a high atmospheric humidity caused by fog, precipitation, mist and dew. More recently, Dennis Gignac (1990) has presented data that the critical factor in limiting the distribution of this species is minimum temperature, not water chemistry or precipitation. *Sphagnum affine* is widespread in temperate eastern North America, from the Gulf Coast northward to Newfoundland, Quebec, Ontario, and Wisconsin, and overlaps with *S. austinii* from New Jersey north to Newfoundland. It is rare west of the Appalachian Mountains, and is not known from western North America. In Britain, Hill (1988) reported that he could not document any incidence of these two taxa growing together, while Flatberg (1984) found only a single mixed stand in Norway. Dick Andrus (*pers. com.*) wrote that he likewise has never seen these two taxa growing together. *Sphagnum steerei* occurs in a broad band from northwestern Alaska, eastward to northern Quebec. Its habitat of subarctic meadows is very different than that of either of the other two species, and its distribution does not overlap with either *S. affine* or *S. austinii*.

Additional reports, new collections, and range extensions should be sent to the first author. These findings can be reported in future editions of this series.

NEXT SPECIES: *Orthotrichum rupestre* Schwaegr.

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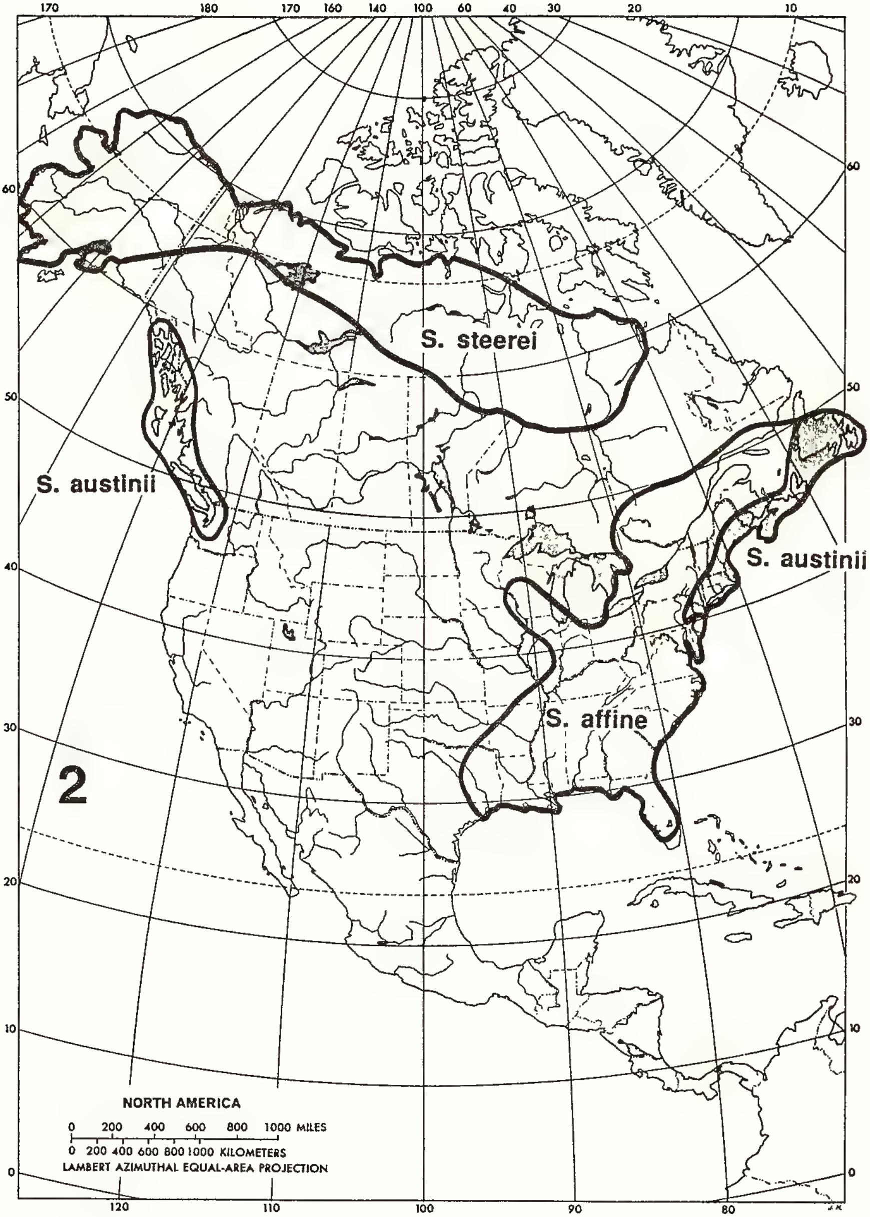
S. steerei
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Bryophytes of Two New York State Freshwater Tidal Swamps

Lorinda Leonardi [1]

A floristic study of bryophytes in the freshwater tidal swamps of the Tivoli Bays, Hudson River National Estuarine Research Reserve was conducted between March 3 and August 3, 1989. The Tivoli Bays (300 ha) is located in the town of Red Hook, Dutchess County, New York (USGS Saugerties, NY quadrangle). The study area consists of two freshwater tidal swamps known as Big Bend Swamp and Cruger Island Neck. The tide is approximately 1.2 m in this section of the river.

Big Bend Swamp (approximately 5 ha) lies on the eastern edge of North Bay near the mouth of Stony Creek. The creek empties into two estuarine channels that surround the swamp. The Neck (approximately 18 ha) connects Cruger Island to the mainland, separating the tidal cat-tail marsh of North Bay from the tidal shallows of South Bay. Both tidal swamps have a dense vegetation cover. Hummocks, formed from shrub and tree roots, are prominent. The soils are predominately muck. The woody plants are primarily *Acer rubrum, Fraxinus pennsylvanica, Fraxinus nigra, Alnus* spp., *Salix* spp., *Lindera benzoin, Cornus amomum, C. stolonifera* and *Lonicera xbella.*

Bryophytes of the Tivoli Bays tidal swamps were collected on 19 field trips. Big Bend Swamp is accessible by canoe and Cruger Island Neck is reached by Cruger Island Road. All specimens were collected by the author, and did not include collection numbers. Specimens were deposited at the Bard College Field Station with some duplicate collections at the New York Botanical Garden (NY) and the New York State Museum (NYS).

Fifty-six taxa of bryophytes were identified in the Tivoli Bays study area. The list of species includes habitat and abundance data derived from the collections and field observations. Species composition is similar for Cruger Island Neck and Big Bend Swamp. The most abundant and widespread species is *Anomodon attenuatus*. Other abundant species are *Plagiomnium cuspidatum* and *Hypnum lindbergii*. *Brachythecium turgidum*, *Desmatodon obtusifolius, Lindbergia brachyptera, Orthotrichum ohioense, O. sordidum, O. stellatum* and *Taxiphyllum taxirameum* are rare in New York State according to Clemants & Ketchledge (1990).

Mosses

Amblystegium juratzkanum Schimp. -- rare; Cruger Island Neck; fallen branches.
Anomodon attenuatus (Hedw.) Hueb. -- abundant; both sites; fallen branches,

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hummocks, logs, and tree bases.

A. minor (Hedw.) Fuernr. -- rare; Big Bend Swamp; shrub.

A. rostratus (Hedw.) Schimp. -- rare; Cruger Island Neck; hummocks.

Atrichum undulatum (Hedw.) P.-Beauv. -- rare; Big Bend Swamp; soil.

Barbula unguiculata Hedw. -- rare; Cruger Island Neck, beside railroad tracks; coal clinkers.

Brachythecium oxycladon (Brid.) Jaeg. & Sauerb. -- rare; Big Bend Swamp; fallen branches.

B. rutabulum (Hedw.) B.S.G. -- uncommon; Cruger Island Neck; hummocks, soil.

B. salebrosum (Web. & Mohr) B.S.G. -- common; both sites; tree bark, fallen branches, hummocks, logs.

B. turgidum (C.J. Hartm.) Kindb. -- uncommon; both sites; hummocks, logs, tree bases.

Brynia novae-angliae (Sull. & Lesq.) Grout -- rare; Cruger Island Neck; hummocks.

Bryum argenteum Hedw. -- rare; Cruger Island Neck; log.

B. caespiticium Hedw. -- rare; Cruger Island Neck, beside railroad tracks; coal clinkers.

B. pseudotriquetrum (Hedw.) Gaertn., Meyer & Scherb. -- uncommon; Cruger Island Neck; logs, soil.

Callicladium haldanianum (Grev.) Crum -- uncommon; Cruger Island Neck; logs.

Ceratodon purpureus (Hedw.) Brid. -- rare; both sites; logs.

Climacium americanum Brid. -- uncommon; Cruger Island Neck; hummocks.

Desmatodon obtusifolius (Schwaegr.) Schimp. -- rare; Big Bend Swamp; soil.

Dicranum montanum Hedw. -- rare; Big Bend Swamp; tree bases.

Entodon seductrix (Hedw.) C. Muell. -- common; both sites; bark, logs, tree bases.

Eurhynchium pulchellum (Hedw.) Jenn. -- common; both sites; hummocks.

Fissidens adiantoides Hedw. -- uncommon; both sites; hummocks, muck.

F. bryoides Hedw. -- rare; Big Bend Swamp; muck.

F. fontanus (B.-Pyl.) Steud. -- rare; Cruger Island Neck; muck.

F. taxifolius Hedw. -- rare; Big Bend Swamp; logs, soil.

Haplocladium microphyllum (Hedw.) Broth.-- uncommon; both sites; logs.

Hygroamblystegium tenax (Hedw.) Jenn. -- common; both sites; fallen branches, hummocks, logs, muck, tree bases.

Hypnum lindbergii Mitt. -- abundant; both sites; fallen branches, logs, hummocks, soil.

Leptodictyum riparium (Hedw.) Warnst. -- uncommon; both sites; fallen branches, muck.

L. trichopodium (Schultz) Warnst. -- rare; Big Bend Swamp; fallen branches.

Leskea gracilescens Hedw. -- abundant; both sites; bark, logs.

L. polycarpa Hedw. -- rare; Cruger Island Neck; bark.

Lindbergia brachyptera (Mitt.) Kindb. -- rare; both sites; bark.

Mnium punctatum Hedw. -- uncommon; both sites; hummocks, logs, muck.

Orthotrichum ohioense Sull. & Lesq. ex Aust. -- both sites; bark.

O. sordidum Sull. & Lesq. ex Aust. -- Cruger Island Neck; bark.
O. stellatum Brid. -- Big Bend Swamp; bark.
Philonotis muhlenbergii (Schwaegr.) Brid. -- uncommon; Cruger Island Neck; soil.
Plagiomnium cuspidatum (Hedw.) Kop. -- abundant; both sites; hummocks, logs, soil.
Plagiothecium cavifolium (Brid.) Iwats. -- uncommon; both sites; hummocks, logs, tree bases.
Platygyrium repens (Brid.) B.S.G. -- common; both sites; bark.
Pohlia sp. -- rare; both sites; hummock.
Polytrichum commune Hedw. -- rare; both sites; soil.
Rhodobryum roseum (Hedw.) Limpr. -- rare; Cruger Island Neck; hummocks.
Rhynchostegium serrulatum (Hedw.) Jaeg. & Sauerb. -- rare; both sites; hummocks.
Taxiphyllum taxirameum (Mitt.) Fleisch. -- rare; both sites; bark, hummocks.
Thuidium delicatulum (Hedw.) B.S.G. -- common; both sites; hummocks, logs.
T. minutulum (Hedw.) B.S.G. -- uncommon; Big Bend Swamp; hummocks, logs.

Liverworts

Aneura pinguis (L.) Dum. -- uncommon; both sites; fallen branches, hummocks, logs.
Conocephalum conicum (L.) Lindb. -- uncommon; Cruger Island Neck; hummocks, logs, tree bases.
Frullania eboracensis Gott. -- common; both sites; bark, logs.
Lophocolea heterophylla (Schrad.) Dum. -- uncommon; both sites; hummocks, logs.
Porella pinnata L. -- rare; Big Bend Swamp; muck, roots.
P. platyphylla (L.) Pfeiff. -- rare; Big Bend Swamp; tree bases, logs, soil.
Riccia fluitans L. -- rare; Cruger Island Neck; muck, water.
Trichocolea tomentella (Ehrh.) Dum. -- rare; Cruger Island Neck; hummocks.

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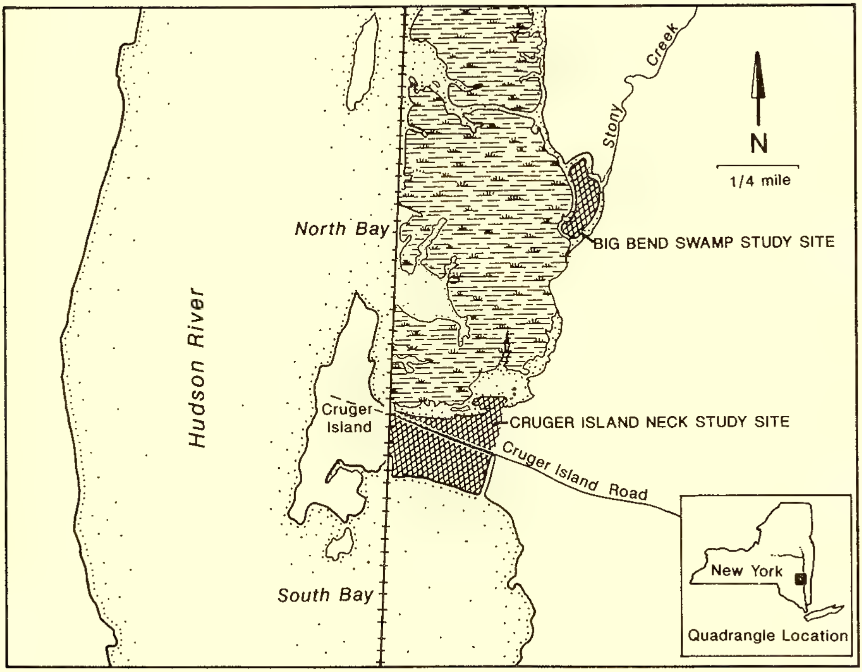

Figure 1. Map of the Tivoli Bays, showing location of study sites.

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New Records for Kansas Mosses, III [1]

G.L. Smith Merrill [2]

This is the third in a continuing series of papers listing new distributional records for mosses in the state of Kansas (Merrill, 1989, 1991). Mosses are reported from 42 Kansas counties. Besides my own specimens, the list includes new records resulting from collections by Iralee Barnard, Rhonda Dettmer, Patricia Hook, and Bonnie Jo Lawson, Kansas State University, Manhattan KS; Vernon L. Wranosky, Colby Community College, Colby KS; W.W. Holland, D.V.M., of Erie KS, and several others. The locations of counties cited in the text are indicated in Fig. 1.

The list which follows is divided into three sections: first, reports of mosses new to the Kansas moss flora; second, reports of species considered rare in Kansas, or those representing noteworthy extensions of range within the state; and third, reports of more common species. Frequency is expressed according to the following scale: "rare" = reported from 1-5 counties, "infrequent" = 6-15, "frequent" = 16-25, and "common" = more than 25.

Distribution of species is given as "widespread" = species found throughout the state, "eastern" = species of the eastern one-third to half of the state, or "western" = species of primarily western affinities, found only in western Kansas. The line between eastern and western Kansas is the 6th Principal Meridian, which roughly corresponds to the western boundary of the Flint Hills upland.

Nomenclature generally follows that of Crum & Anderson (1981). Specimens cited by number only are my own collections. All specimens are deposited in the Reed Bryophyte Herbarium, Kansas State University (KSC), unless indicated otherwise.

I. Additions to the Kansas Moss Flora

Aphanorrhegma serratum (Hook.f. & Wils. ex Drumm.) Sull. CHEROKEE CO: 6mi E of Baxter Springs, 9 Oct 1948, McGregor 2559 (NY); DOUGLAS CO: Maurice L. Breidenthal Biological Reserve, 2mi N of Baldwin City, Cridland s.n. (DUKE); 2mi NE of Lawrence, 26 Sep 1948, McGregor 2463 (NY); MIAMI CO: banks of the Marais des Cygnes River, 3 Oct 1948, McGregor 2471 (NY). The collection at DUKE is a permanent microscope slide prepared by Dr. Lewis Anderson from material sent to him by Arthur Cridland in 1959; the original specimen has not been located (Anderson, pers. com.). The Kansas collections at NY of this and the next species have been annotated by Allan Fife as correctly determined (W.R. Buck, pers. com.)

---

[1] Contribution no. 91-357-J from the Kansas Agricultural Experiment Station.

[2] Division of Biology, Kansas State University, Manhattan, Kansas 66506-4901

Physcomitrium immersum Sull. DOUGLAS CO: McGregor 2463; MIAMI CO: McGregor 2471 (see data for the preceding species). Mixed with *Aphanorrhegma serratum*.

Platydictya confervoides (Brid.) Crum DOUGLAS CO: on limestone rock, University of Kansas Natural History Reservation, 19 Mar 1954, Hartmann & McGregor 41, det. H.S. Conard. Earlier reported for Kansas by McGregor (1950), but excluded by Churchill (1985) for lack of a voucher specimen. This collection, reported by Hartmann (1956), was included with the mosses recently transferred to KSC from Emporia State University.

II. Additional County Records for Rarer Kansas Mosses

Atrichum altecristatum (Ren. & Card.) Smyth & Smyth (=*A. undulatum* var. *altecristatum*) ATCHISON CO: on wooded slope, 5km N of Atchison, 28 Apr 1978, Churchill 9560; CLOUD CO: sandstone rock and sandy soil, 13 Sep 1948, S.V. Fraser 2 (IA); COWLEY CO: N-facing wooded bluff above Cedar Creek, ca 6km W of Cedar Vale, 24 Nov 1978, Churchill 10610; FRANKLIN CO: 1 May 1902, Grace Meeker 32 (NY); JACKSON CO: on shaded creek bank, 8.8km N of Holton, 12 May 1978, Churchill 9629; JEFFERSON CO: 25 Apr 1978, Churchill 9496; SALINE CO: Joseph Henry (Syntype of *Atrichum undulatum* var. *altecristatum*, PC!); WASHINGTON CO: 28 Apr 1963, H.L. Smith 1773 (NY). Infrequent; eastern. *Atrichum altecristatum* is monoicous, although this may not be apparent on cursory examination. When fruiting, a few stems can usually be found with an inconspicuous antheridial inflorescence midway up the stem, even though many stems with sporophytes bear only archegonia. The median leaf cells in *Atrichum angustatum*, a common species in eastern Kansas, are bulging mamillose and smaller (8-15μm vs 20-25μm) than in *A. altecristatum*. For additional discussion of this species, see Ireland (1969).

Entodon cladorrhizans (Hedw.) C. Müll. MARION CO: on limestone outcrop and stone wall, old farmstead overgrown with trees, 2mi NE of Marion, 3 Oct 1990, 12483; NEOSHO CO: wooded N-facing oak-hickory hillside near Neosho River, ca 3mi W of Erie, 18 Nov 1989, Holland 6155b, det. Steve Timme. Rare; eastern. Previously reported from Jefferson County (Merrill, 1991), Johnson and Lyon Counties (Churchill, 1985), as well as from Saline County by Renauld & Cardot (1892).

Ephemerum crassinervium (Schw.) Hampe SHAWNEE CO: on soil among grasses in prairie remnant, W. Clement Stone Nature Center, 2mi W of Topeka, 18 Oct 1990, 12516. Rare; eastern. Previously reported from Morris, Pottawatomie, and Reno Counties.

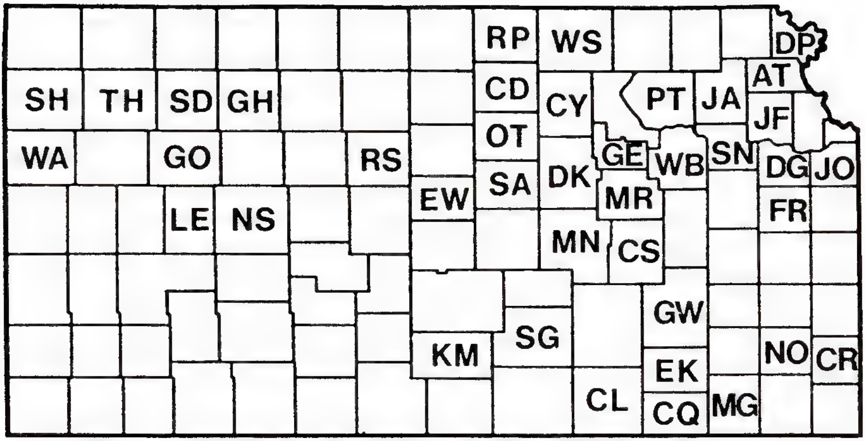

Fig. 1. County outline map of Kansas, indicating the location of counties from which mosses are reported in the text. AT = Atchison; CD = Cloud; CK = Cherokee; CL = Cowley; CQ = Chautauqua; CR = Crawford; CS = Chase; CY = Clay; DG = Douglas; DK = Dickinson; DP = Doniphan; EK = Elk; EW = Ellsworth; FR = Franklin; GE = Geary; GH = Graham; GO = Gove; GW = Greenwood; JA = Jackson; JF = Jefferson; JO = Johnson; KM = Kingman; LE = Lane; MG = Montgomery; MI = Miami; MN = Marion; MR = Morris; NO = Neosho; NS = Ness; OT = Ottawa; PT = Pottawatomie; RP = Republic; RS = Russell; SA = Saline; SD = Sheridan; SG = Sedgwick; SH = Sherman; SN = Shawnee; TH = Thomas; WA = Wallace; WB = Wabaunsee; WS = Washington.

Fissidens fontanus (B.-Pyl.) Steud. MARION CO: in running stream fed by springs, Chingawassa Springs, 2mi NE of Marion, 3 Oct 1990, 12496. Rare; previously reported from Cherokee, Crawford, and Woodson Counties in extreme SE Kansas, and from Ellsworth County in the center of the state.

Physcomitrium hookeri Hampe RUSSELL CO: under bridge, dry creek bed, 0.5mi S of Paradise, 13 Mar 1990, Wranosky 11. Rare in Kansas; scattered reports from Gove, McPherson, Meade, and Riley Counties (Churchill, 1985). Leaves ovate and entire, with costa ending shortly below the apex; capsules in this collection are green and immature.

Platygyrium repens (Brid.) B.S.G. ELLSWORTH CO: on shaded sandstone boulder, Horsethief Canyon, 4mi SE of Carneiro, 8 Oct 1989, 11999; SHAWNEE CO: 12526; WABAUNSEE CO: 12589. Frequent; eastern. The Ellsworth County collection represents a westward extension of range of about 80 miles. This species has characteristic clusters of brood branches in the leaf axils at the tips of the stems. A moss which typically grows on rotting wood, *Platygyrium* should be looked for on moist sandstone outcrops elsewhere in the central part of the state. *Entodon seductrix*, another species which normally occurs on rotting wood, covers extensive areas on shaded sandstone cliffs at the Ellsworth locality.

Pogonatum brachyphyllum (Mx.) Beauv. MARION CO: on moist face of sandstone boulder at edge of seep in prairie pasture, ca 6mi S of Carlton, 17 Aug 1990, 12467. Infrequent; eastern, but with one record farther west in Ellsworth County (Churchill, 1985). This and the following species were collected only a few paces apart. Both species have a tough protonemal mat with tiny, scattered leafy shoots.

Pogonatum pensilvanicum (Hedw.) Beauv. MARION CO.: on moist sandstone outcrop in prairie pasture, ca 6mi S of Carlton, 17 Aug 1990, 12470. Rare; eastern. Previously reported from Douglas and Washington Counties.

Pterygoneurum subsessile (Brid.) Jur. SALINE CO: "on rocks, Saline county", Joseph Henry (Rau, 1886). Frequent; western. Churchill (1985) evidently overlooked this report, an eastward extension of range of about 100 miles. Based on the type collection of *Barbula henrici* Rau, which is treated as *P. subsessile* var. *henrici* by Crum & Anderson (1981), and the report of the species by Renauld & Cardot (1892). Except for Barber and Sumner Counties in south central Kansas, all previous records for this species are in the western third of the state.

Rhodobryum ontariense (Kindb.) Kindb. MONTGOMERY CO: on shaded rock in forest, Elk City Lake, Lookout Point, 10 Jun 1990, Barnard KSC 4622. Rare; eastern. Previously reported from Riley (Merrill, 1989), Jackson, and Leavenworth Counties, all in NE Kansas, but also listed from Saline County by Renauld & Cardot (1892).

Sematophyllum demissum (Wils.) Mitt. DICKINSON CO: on sandstone, ca 5mi S of Carlton, Barnard KSC 4681. Rare; eastern. Previously reported from Douglas, Franklin, Montgomery, Wilson, and Woodson Counties (Churchill, 1985). This collection extends the range of the species westward about 100 miles.

III. New County Records for More Common Species

Amblystegium serpens (Hedw.) B.S.G. DICKINSON CO: Barnard KSC 4304; GOVE CO: Wranosky 4. Frequent; widespread but scattered reports across the state.

Amblystegium varium (Hedw.) Lindb. DONIPHAN CO: 12358, 12362; ELK CO: 12203; MARION CO: 12495; SHAWNEE CO: 12525, 12531; WABAUNSEE CO: 12581. Common; eastern half of Kansas.

Anomodon minor (Hedw.) Fuernr. ELK CO: 12200; GEARY CO: Barnard KSC 4567; MARION CO: 12493. Frequent; eastern.

Anomodon rostratus (Hedw.) Schimp. MONTGOMERY CO: 12209. Infrequent; only in eastern Kansas.

Astomum muhlenbergianum (Sw.) Grout GREENWOOD CO: 12176; SHERMAN CO: Wranosky 46; SHAWNEE CO: 12518. Common; widespread.

Atrichum angustatum (Brid.) B.S.G. DICKINSON CO: Barnard KSC 4496; DONIPHAN CO: 12355; MARION CO: 12449, 12471; NEOSHO CO: Holland 6155a. Common; eastern.

Barbula unguiculata Hedw. CHAUTAUQUA CO: 12227; GOVE CO: Wranosky 4, 5, 6, 7, 9; GREENWOOD CO: 12174a; KINGMAN CO: 12333, 12334; LANE CO:

Wranosky 73; MARION CO: 12433, 12487; OTTAWA CO: 12296; THOMAS CO: Wranosky 23; WALLACE CO: Wranosky 18. Common; widespread.

Brachythecium oxycladon (Brid.) Jaeg. MORRIS CO: K-593. Common; eastern half of the state, but also reported in Clark, Hodgeman, and Scott Counties in western Kansas.

Bryum argenteum Hedw. DICKINSON CO: Barnard KSC 4583; GOVE CO: Wranosky 6, 7; MARION CO: 12466; NESS CO: Wranosky *68; WALLACE CO: Wranosky 17. Common and widespread.

Bryum caespiticium Hedw. GOVE CO: Wranosky 7. Common and widespread.

Bryum cuspidatum auct. (=*Bryum lisae* var. *cuspidatum*; *B. creberrimum* auct. non Tayl.) MARION CO: 12434. Frequent; widespread.

Bryum pseudotriquetrum (Hedw.) Gaertn. MARION CO: Barnard KSC 4555; OTTAWA CO: 12294; RUSSELL CO: Wranosky 10, 12; THOMAS CO: Wranosky 15. Frequent in the east; rare in the west.

Campylium chrysophyllum (Brid.) J. Lange DICKINSON CO: Barnard KSC 4553; MARION CO: 12440; NEOSHO CO: Holland 6155c. Frequent; eastern Kansas.

Campylium hispidulum (Brid.) Mitt. MARION CO: 12438; SHAWNEE CO: 12523a. Common; widespread.

Ceratodon purpureus (Hedw.) Brid. GEARY CO: Lawson KSC 4913; OTTAWA CO: 12312; WASHINGTON CO: Wranosky 25. Common; eastern, plus a record from Wichita County in far western Kansas (Churchill, 1985).

Desmatodon obtusifolius (Schwaegr.) Schimp. CRAWFORD CO: Holland KSC 120, det. W.C. Steere; MARION CO: 12441, 12484. Common; widespread.

Desmatodon plinthobius Sull. & Lesq. GEARY CO: Barnard KSC 4497; GOVE CO: Wranosky 19b; LANE CO: Wranosky 72b, 76; MARION CO: 12443, 12447, 12482; NESS CO: Wranosky *64, *65. Common; widespread.

Dicranella varia (Hedw.) Schimp. CHASE CO: 12317; KINGMAN CO: 12334. Infrequent; eastern half of Kansas.

Didymodon rigidulus Hedw. LANE CO: Wranosky 72c; NESS CO: Wranosky *64, *66. Infrequent; western.

Didymodon tophaceus (Brid.) Lisa CHASE CO: 12314; MARION CO: Barnard KSC 4273. Infrequent; widespread.

Entodon compressus C. Müll. DICKINSON CO: Barnard KSC 4568; MARION CO: 12428; SHAWNEE CO: 12541, 12544. Frequent; eastern.

Entodon seductrix (Hedw.) C. Müll. CLAY CO: Barnard KSC 4904; DICKINSON CO: Barnard KSC 4271; MARION CO: 12508; REPUBLIC CO: Barnard KSC 4742; SHAWNEE CO: 12542; WABAUNSEE CO: 12590. Common; eastern.

Eurhynchium hians (Hedw.) Sande-Lac. DONIPHAN CO: 12374. Frequent; eastern.

Eurhynchium pulchellum (Hedw.) Jenn. OTTAWA CO: 12305; POTTAWATOMIE CO: 12568. Infrequent; eastern.

Fabronia ciliaris (Brid.) Brid. ELK CO: 12202; SHAWNEE CO: 12519. Frequent; eastern half of Kansas.

Fissidens bryoides Hedw. sens. lat. SHAWNEE CO: 12533; WABAUNSEE CO:

12585. Frequent; widespread. The species of the *F. bryoides* complex have not been distinguished in Kansas (Churchill, 1985; Merrill, 1991).

Fissidens cristatus Wils. ex Mitt. MARION CO: 12456. Infrequent; eastern half of Kansas. Growing in compact upright cushions on moist N-facing slopes, as in neighboring Saline (Merrill, 1991) and Ellsworth Counties.

Fissidens obtusifolius Wils. DICKINSON CO: Barnard KSC 4906; MARION CO: 12437, 12503; SHAWNEE CO: 12532. Frequent; eastern half of Kansas, with one far western record in Stanton County (Churchill, 1985).

Fissidens taxifolius Hedw. MARION CO: 12458; SHAWNEE CO: 12539. Infrequent; eastern.

Funaria flavicans Mx. NEOSHO CO: Holland 5227. Frequent; eastern half of Kansas.

Funaria hygrometrica Hedw. SHAWNEE CO: P. Hook KSC 4628. Frequent eastern, rare in western Kansas.

Grimmia laevigata (Brid.) Brid. DICKINSON CO: Barnard KSC 4682. Frequent; central and southeast Kansas.

Homomallium adnatum (Hedw.) Broth. MARION CO: 12419, 12489; SHAWNEE CO: 12537. Common; eastern third of Kansas.

Hygroamblystegium tenax (Hedw.) Jenn. (=*Amblystegium*) CHASE CO: 12315, 12316; MARION CO: Barnard KSC 4274. Common; primarily eastern, but also in Scott and Trego Cos., in the western third of the state.

Jaffueliobryum raui (Aust.) Ther. (=*Grimmia*) DICKINSON CO: Barnard KSC 4684; NESS CO: Wranosky *65. Frequent; western. The Dickinson County collection is the first report of the species from "eastern" Kansas.

Jaffueliobryum wrightii (Sull. in Gray) Ther. (=*Grimmia*) LANE CO: Wranosky 72a, 75; MARION CO: 12447, Barnard KSC 4689; NESS CO: Wranosky *65; SHERIDAN CO: Wranosky 51. Frequent; western. The Marion County collection is the first report from "eastern" Kansas.

Leptodictyum riparium (Hedw.) Warnst. (=*Amblystegium*) DICKINSON CO: Barnard KSC 4305; DONIPHAN CO: 12362; ELK CO: 12203; MARION CO: 12497; SHAWNEE CO: 12523; WABAUNSEE CO: 12583. Frequent; eastern half of Kansas.

Leskea gracilescens Hedw. NEOSHO CO: Holland 4978. Common; eastern two-thirds of Kansas.

Lindbergia brachyptera (Mitt.) Kindb. GREENWOOD CO: 12193; MARION CO: 12494; NEOSHO CO: Holland 4978c. Common; eastern.

Orthotrichum diaphanum Brid. GOVE CO: Wranosky 19a; MARION CO: 12512a. Infrequent; middle third of the state.

Orthotrichum pumilum Sw. MARION CO: 12509, 12512; POTTAWATOMIE CO: K-432. Common; eastern two-thirds of Kansas.

Phascum cuspidatum Hedw. GRAHAM CO: Wranosky 79; SHAWNEE CO: 12517. Common; widespread.

Philonotis marchica (Hedw.) Brid. MARION CO: 12416, 12425. Infrequent; eastern.

Physcomitrium pyriforme (Hedw.) Hampe GEARY CO: 11599; GREENWOOD CO:

12174; NEOSHO CO: Holland 5007; SEDGWICK CO: Carleton 131. Common; eastern two-thirds of Kansas.

Plagiomnium cuspidatum (Hedw.) Kop. (=*Mnium*) DICKINSON CO: Barnard KSC 4908; MARION CO: 12465; REPUBLIC CO: Barnard KSC 4741. Common; eastern half of Kansas.

Pohlia nutans (Hedw.) Lindb. MARION CO: 12473. Infrequent; eastern Kansas.

Pohlia wahlenbergii (Web. & Mohr) Andr. DICKINSON CO: Barnard KSC 4645; MARION CO: Barnard KSC 4276. Infrequent; primarily in the northern half of the state.

Polytrichum juniperinum Hedw. MARION CO: 12477. Infrequent; eastern.

Pylaisiella selwynii (Kindb.) Crum, Steere & Anderson NEOSHO CO: Holland 4978b. Infrequent; eastern two-thirds of Kansas.

Rhynchostegium serrulatum (Hedw.) Jaeg. MARION CO: 12431, 12454. Common; eastern.

Schistidium alpicola (Hedw.) Limpr. (=*Grimmia*) DICKINSON CO: Barnard KSC 4279; JOHNSON CO: Dettmer 2; MARION CO: 12446. Common; eastern.

Thelia asprella Sull. NEOSHO CO: Holland 6155d. Infrequent; eastern.

Tortula pagorum (Milde) De Not. MARION CO: 12510; MONTGOMERY CO: 12204. Infrequent; eastern.

Weissia controversa Hedw. DONIPHAN CO: 12350; LANE CO: Wranosky 71, 74; MARION CO: 12445, 12506; NESS CO: Wranosky *67, *68, *70; SEDGWICK CO: 12335. Common and widespread in Kansas.

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Should mosses have common names?
Part 5. The Common Names of Pottiales

Janice M. Glime [1]

The Pottiales have lots of interesting characters, often adapting them to xerophytic conditions, and with these come many interesting names. The screw mosses (*Tortula* spp.) are named for the corkscrew shape of the leaves when the plant is dry, and perhaps also for a similar habit of the peristome teeth, a character that earns other members of the genus the name of twisted moss. *Aloina* has been named aloe moss because of resemblance to that medicinal xerophytic plant.

The common name of *Encalypta* refers to the cone-shaped calyptra that is persistent and completely covers the capsule. Diana Horton informs me that the earliest common name for the genus is from Petiver in 1695, who used extinguisher moss. The Japanese name likewise refers to the calyptra, but likens it to the straw hoods that Buddhist priests put on their heads in older times. *Encalypta ciliata* has earned the Japanese name of yarikatsugi moss, the soldier who carries a covered spear, because the calyptra is shaped like that covered spear. In 1827, Nees, Hornschuch, and Sturm called it Glockenhut (bell hat).

Other interesting names for these mosses come from the Japanese. Menbou-goke is the rolling pin moss, referring to the shape of *Anoectangium*. The Japanese name of parrot moss is much more interesting than the western name of curve-beaked beardless moss for *Hymenostylium recurvirostrum* (= *Gymnostomum*).

The name of copper moss for *Scopelophila* of course refers to its rather unusual habit of growing in association with copper. However, now it seems to be rather widely believed that it is in fact not a copper-requiring moss, but rather one that requires high sulfur content (or perhaps the associated low pH) and tolerates copper.
In the following list, conventions in formatting follow Glime (1989). The **meaning** of the scientific name, as supplied by Elizabeth Dunham, is provided immediately after the scientific name. The structure to which the name applies is in parentheses. Nomenclature follows Crum, Anderson & Buck (1990).

Calymperaceae
Syrrhopodon: netted-leaf moss[13]

Encalyptaceae
Encalypta: extinguisher mosses[2, 4, 10]; extinguisher moss[8]; to cover with a veil

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(calyptra)[9]; komuso moss (straw priest's hood moss)[13]; extinguisher-moss[20]; bell hat[22]
Encalypta alpina Sm.: Mt. Shiruma yarikatsugi moss[13]; confused bell hat[22]
Encalypta ciliata Hedw.: fringed extinguisher moss[8, 11]; yarikatsugi moss (soldier who carries covered spear)[13]; candle snuffer moss[21]; fringed bell hat[22]
Encalypta procera Bruch: blunt extinguisher moss[24]
Encalypta rhaptocarpa Schwaegr.: extinguisher moss[5]; striated-fruited extinguisher[8]; rib-fruited extinguisher moss[11]; ribbed bell hat[22]
Encalypta vulgaris Hedw.: common extinguisher moss[7, 8, 11]; common bell hat[22]

Pottiaceae
Acaulon muticum (Hedw.) C. Müll.: common dwarf earth moss[8]; common earth moss[11]; common dwarf moss[14]
Acaulon triquetrum (Spruce) C. Müll.: triquetrous earth moss[8]; triangular earth moss[11]
Aloina: rigid screw moss[8]; aloe moss[14]
Aloina brevirostris (Hook. & Grev.) Kindb.: short-beaked rigid screw moss[8]; short beaked screw moss[11]
Aloina rigida (Hedw.) Limpr.: aloe-like rigid screw moss[8]; rigid screw moss[11]; obtuse leafed aloe moss[14]
Anoectangium: branched beardless moss[8]; menbou-goke = rolling pin moss[13]
Aschisma: no mouth moss[14]
Astomum: pygmy mosses[2]; tsubo-goke = urn moss[13]; brownies[17]
Astomum muhlenbergianum (Sw.) Grout: mouthless moss[24]
Barbula: little beard mosses[2]; little-beard mosses[4]; beard mosses[7]; twisted mouth moss[13]; twisted teeth moss[14]; red-bearded moss[17]
Barbula convoluta Hedw.: convolute screw moss[8]; sheath-leaved screw moss[11]; Ezo-nejikuchi-goke = Ezo twisted mouth moss[13]; roll-leafed twisted teeth moss[14]; yellow stalk beardlet moss[24]
Barbula indica (Hook.) Spreng. *in* Steud.: twisted teeth moss[14]
Barbula unguiculata Hedw.: claw-leaved barbula[2, 4]; birds-claw screw moss[8]; bird's claw screw moss[11]; twisted thread moss[13]; bird's-claw screw-moss[20]; clawtip twisted beardlet moss[24]
Bryoerythrophyllum: red leaf moss[14, 24]
Bryoerythrophyllum recurvum (Griff.) Saito: curved-beaked weissia[8]; red twin-toothed moss[11]
Crossidium: tassel moss[14]
Crossidium crassinerve (De Not.) Jur.: broad-nerved earth moss[8]
Desmatodon: chain-teeth moss[14]
Desmatodon cernuus (Hüb.) Bruch & Schimp. *in* B.S.G.: narrow-leafed chain-teeth moss[14]
Desmatodon heimii (Hedw.) Mitt.: long-stalked beardless moss[8]; lance-leaved

pottia[11]

Desmatodon latifolius (Hedw.) Brid.: broad-leaved fork moss[8]; common chain-teeth moss[14]

Didymodon: twin tooth (peristome)[9]

Didymodon fallax (Hedw.) Zand.: fallacious screw moss[8, 11]; makiha-neji-hige-goke = twisted mouth moss[13]; brownish beardlet moss[24]

Didymodon fallax var. *reflexus* (Brid.) Zand.: jimukade-goke = jimukade moss (named for alpine plant)[13]

Didymodon rigidulus Hedw.: rigid-leaved didymodon[8]; rigid screw moss[11]

Didymodon tophaceus (Brid.) Lisa: three-ranked didymodon[8]; blunt-leaved hair moss[11]

Didymodon vinealis (Brid.) Zand.: soft-tufted screw moss[11]

Didymodon vinealis var. *rubiginosus* (Mitt.) Zand.: high water moss[23]

Eucladium: beautiful-branch moss[14]

Eucladium verticillatum (Brid.) Bruch & Schimp. *in* B.S.G.: whorled weissia[8, 11]; common beautiful-branch moss[14]

Geheebia gigantea (Funck) Boul.: large twin moss[13]

Gymnostomiella: papillose kettle moss[14]

Gymnostomiella orcuttii Bartr.: propaguliferous moss[13]

Gymnostomum: toothless twisted mosses[2]; beardless moss[8]; toothless moss[13]; naked-mouth moss[14]

Gymnostomum aeruginosum Sm.: tufted rock beardless moss[8]; rock beardless moss[11]; yellow-fruited tufa moss[24]

Gymnostomum calcareum Nees & Hornsch. *in* Nees et al.: blunt leaf tufa moss[24]

Gymnostomum recurvirostrum Hedw.: bent beak tufa moss[24]

Gyroweisia: round-mouth moss[14]

Gyroweisia tenuis (Hedw.) Schimp.: slender beardless moss[11]; common round-mouth moss[14]

Hymenostylium recurvirostrum (Hedw.) Dix.: curved-beaked beardless moss[8]; curve-beaked beardless moss[11]; parrot moss[13]; hook-beak naked-mouth moss[14]

Hyophila: wet-ground moss[14]

Hyophila involuta (Hook.) Jaeg.: inrolled Pott moss[12]; incurved leaf moss[13]; rolled-leaf wet-ground moss[14]

Leptodontium: thin-teeth moss[14]

Oxystegus: acid-soil moss

Oxystegus spiralis (Grout) Crum & Anderson: slender-beaked weissia[8]; slender-fruited twin-toothed moss[11]

Phascum: earth moss[8]; ball moss[14]

Phascum cuspidatum Hedw.: cuspidate earth moss[8]; horn-leaved earth moss[11]; common ball moss[14]; pointed earth-moss[20]; globe moss[24]

Phascum floerkeanum Web. & Mohr.: Floerke's dwarf earth moss[8]; brown earth moss[11]

Pleurochaete: lateral-capsule moss[14]

Pleurochaete squarrosa (Brid.) Lindb.: spreading-leaved screw moss[11]; common lateral-capsule moss[14]

Pottia: for Pott of Germany[9]; tuft moss[14]

Pottia bryoides (Dicks.) Mitt.: tall earth moss[8]; moss-like earth moss[11]

Pottia davalliana (Sm. *in* Drake) C. Jens.: blunt-lidded beardless moss[8]; smallest pottia[11]

Pottia intermedia (Turn.) Fürnr.: large tuft moss[14]

Pottia lanceolata (Hedw.) C. Müll.: lance-leaved weissia[8]; lance-leaved anacalypta[11]; teethed tuft moss[14]

Pottia starkeana (Hedw.) C. Müll.: Starkean weissia[8]; Starke's anacalypta[11]

Pottia truncata (Hedw.) Fürnr. *ex* B.S.G.: little blunt-fruited beardless moss[8]; common pottia[11, 20]; common tuft moss[14]; little flare mouth moss[24]

Pottia wilsonii (Hook.) Bruch & Schimp. *in* B.S.G.: Wilsonian beardless moss[8]; oval-fruited pottia[11]

Pterygoneurum: salty-soil moss[14]

Pterygoneurum ovatum (Hedw.) Dix.: hairy-leaved beardless moss[8]; oval-leaved pottia[11]

Scopelophila: copper moss[10]; among rocks Pottiaceae[13]; tongue-leaf moss[14]

Scopelophila cataractae (Mitt.) Broth.: Honmon Temple moss[13]; sword tongue-leaf moss[14]

Scopelophila ligulata (Spruce) Spruce: among rocks Pottiaceae[13]; common tongue-leaf moss[14]

Timmiella: thousand cucurbita moss[13]; reverse-twist moss[14]

Timmiella anomala (Bruch & Schimp. *in* B.S.G.) Limpr.: common reverse-twist moss[14]

Tortella: twisted (peristome)[9]; twisted thread moss (from peristome)[13]; twist moss[14]

Tortella fragilis (Hook. & Wils. *in* Drumm.) Limpr.: fragile screw moss[11]; fragile-leaf twist moss[14]

Tortella humilis (Hedw.) Jenn.: tufted barbula[4]; tuft twist moss[14]; twisted moss[16]; small leaf twisted moss[24]

Tortella inclinata (Hedw. *f.*) Limpr.: bent screw moss[11]

Tortella tortuosa (Hedw.) Limpr.: twisted moss[3, 24]; frizzled mountain screw moss[8]; curly-leaved screw moss[11]; false twisted moss[13]; common twist moss[14]

Tortula: twisted (peristome)[9]; twisted mosses[2, 6]; screw moss[10]; twisted moss[13]; wall moss[14]

Tortula laevipila (Brid.) Schwaegr.: small hairy screw moss[11]; wide-leaved screw-moss, smaller hairy screw moss [20]

Tortula latifolia Bruch *ex* Hartm.: wide-leaved screw moss[11]

Tortula mucronifolia Schwaegr.: non-papillose wall moss[14]; sharp twisted moss[24]

Tortula muralis Hedw.: wall moss[3]; wall screw moss[7, 8, 11]; spatulate leaf twisted moss[13]; ubiquitous wall moss[14]; wall-moss[17]; wall screw-moss[20]

Tortula papillosa Wils. *in* Spruce: twisted moss[5]; rough-leaved screw moss[11]; roughish-leaved screw-moss[20]

Tortula princeps De Not.: common twisted moss[2]; great screw moss[11]; large wall moss[14]

Tortula ruralis (Hedw.) Gaertn. et al.: hairy screw moss[7]; great hairy screw moss[8, 11]; soil wall moss[14]; great hairy screw-moss[20]; rough awn twisted moss[24]

Tortula sinensis (C. Müll.) Broth.: Chinese wall moss[14]

Tortula subulata Hedw.: awl leaved screw moss[7]; awl-shaped screw moss[8]; awl-leaved screw moss[11]; common wall moss[14]; awl-leaved screw-moss[20]

Trichostomum: mustache mouth moss[13]; hairy mouth moss[14]

Trichostomum brachydontium Bruch in F. Muell.: sharp-toothed didymodon[8]; variable hair moss[11]; common hairy mouth moss[14]

Trichostomum crispulum Bruch in F. Muell.: curled weissia, obscure didymodon[8]; curly-leaved hair moss[11]; crisped mustache mouth moss[13]; crease-leaf hairy mouth moss[14]

Weissia: for Weis of Germany[9]; small-rock moss[14]

Weissia condensa (Voit) Lindb.: curly-leaved beardless moss[11]

Weissia controversa Hedw.: green-cushioned weissia[8]; controverted moss[11]; common small-rock moss[14]; star nose moss[24]

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The French Lichen Association intends to organize at Paris, May 13-15 1993, an international level meeting on the following theme:

Lichenized and non lichenized Ascomycetes.
Progress and perspectives in Systematics.

The meeting will feature general lectures, discussions and a poster session. For further details please contact:

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Notes on Texas Mosses IV.

Robert E. Magill [1]

During routine identification of mosses at the Missouri Botanical Garden a long neglected group of specimens from Texas caught my eye. Most of these specimens were collect between 1940 and 1950; many at sites that no longer exist in a natural state due to subsequent development. *The Mosses of Texas: a manual of the flora with sketches* by Wm. F. Mahler (1980) was very useful in identifying these specimens. This work contains keys and short descriptions of the state's moss flora but does not provide county distributions. Several papers on various aspects of Texas bryology have been published since Mahler's flora appeared. These include articles by Lodwick & Snider (1980), Neumann et al. (1983), Redfearn (1981), Reese (1984, 1989, 1990), Wyatt & Stoneburner (1980), Wyatt et al. (1980), Stoneburner & Wyatt (1979), and Worthington (1989).

Two of the collections represent new state records (marked with * in the following list). *Macromitrium richardii* has been collected sporadically in the southeastern United States and along the Gulf Coast to Louisiana; then in Mexico to southern South America and Africa. Its presence in eastern Texas is therefore not unexpected. The species is apparently rare in Texas; the collection may represent the western edge of the southern Louisiana population. Perhaps climate or habitat requirements restrict its expansion into the moist forests of eastern Texas.

Conardia compacta was also not previously reported from Texas flora although this widespread northern species had been reported from localities as near as Missouri, Arizona and Mexico. The collections represent another interesting disjunct species in the mountains of western Texas. The site is not far from where *Venturiella sinensis* grows in Texas.

Several well known or widespread taxa are here reported as new county records; an indication of the need for further collecting in the state. One duplicate of each collection is deposited at MO and SMU.

Atrichum angustatum (Brid.) B.S.G. - TYLER CO. Beech woods west of Woodville on US 190. 22 March 1941. Lundell & Lundell 9734.

Anomodon rostratus (Hedw.) Schimp. - TYLER CO. Pineland west of Woodville on US 190. 22 March 1941. Lundell & Lundell 9733.

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Barbula unguiculata Hedw. - JEFFERSON CO. Along railroad near Cheek. 25 March 1942. Lundell & Lundell 10916.

Brachythecium acuminatum (Hedw.) Aust. - ANGELINA CO. North of Lufkin off US 59. 11 April 1942. Lundell & Lundell 11098. - HARDIN CO. Wet Palmetto-hardwood forest north of Sour Lake. 16 April 1942. Lundell & Lundell 11216.

Campylium hispidulum (Brid.) Mitt. - WOOD CO. In bog Lake Ellis. 24 April 1942. Lundell & Lundell 11330.

* *Conardia compacta* (C. Müll.) Robinson - CULBERSON CO. On limestone, Victoria Canyon. 20 April 1947. Harvill 2779. - Exposed limestone, plateau above Victoria Canyon. 20 April 1947. Harvill 2775.

Didymodon tophaceus (Brid.) Lisa. - TARRANT CO. Wet ledge west of Irving off Pipeline Road. 6 May 1941. Lundell & Lundell 10480.

Entodon cladorrhizans (Hedw.) C. Müll. - HARDIN CO. Hardwood swamp north of Sour Lake. 23 March 1942. Lundell & Lundell 10880.

Fissidens bryoides Hedw. - ANGELINE CO. Pineland south of Zavalla off US 69. 22 March 1941. Lundell & Lundell 9709B.

Funaria hygrometrica Hedw. - BROOKS CO. Low sandy area south of Falfurrias. 19 March 1942. Lundell & Lundell 10812. - DALLAS CO. Fallow field, Carrollton. 3 May 1941. Lundell & Lundell 10436. - JASPER CO. On soil near Evadale. 15 April 1942. Lundell & Lundell 11171. - POLK CO. Roadside off US 190 west of Woodville. 22 March 1941. Lundell & Lundell 9722. - WOOD CO. On bank at Woodvale Lake east of Mineola. 25 April 1942. Lundell & Lundell 11355.

Funaria calvescens Schwaegr. - BLANCO CO. On soil off US 290 west of Henly. 20 April 1941. Lundell & Lundell 10276.

Gymnostomum recurvirostrum Hedw. - TRAVIS CO. Wet limestone rock, caves on Pedernales River west of Austin. 28 May 1953. Whitehouse 26960.

Haplocladium microphyllum (Hedw.) Broth. - ANGELINE CO. Pineland off US 69 south of Zavalla. 22 March 1941. Lundell & Lundell 9707.

Leskea gracilescens Hedw. - CROCKETT CO. Near Mixon. 15 February 1954. G. Krueger s.n.

Leucobryum albidum (Brid.) Lindb. - NACOGDOCHES CO. Pine-hardwood forest south of Nacogdoches. 10 April 1942. Lundell & Lundell 11081.

Leucodon julaceus (Hedw.) Sull. - TYLER CO. Beech woods off US 190 west of Woodville. 22 March 1941. Lundell & Lundell 9736.

* *Macromitrium richardii* Schwaegr. - HARDIN CO. Wet palmetto-hardwood forest north of Sour Lake. With Schlotheimia rugifolia and Leucodon julaceus. 16 April 1942. Lundell & Lundell 11223E.

Phascum cuspidatum Hedw. - GRAYSON CO. Hagerman Wildlife Refuge west of Pottsboro. 28 February 1954. Whitehouse 27932.

Physcomitrium pyriforme (Hedw.) Hampe - DALLAS CO. Wet depression in prairie, north end of White Rock Lake. 25 March 1941. Lundell & Lundell 9770. - WOOD CO. In bog at Lake Ellis. 24 April 1942. Lundell & Lundell 11331.

Pleurochaete squarrosa (Brid.) Lindb. - TRAVIS CO. On soil of cedar brakes near Beecanes west of Austin. 21 April 1941. Lundell & Lundell 10294.

Thelia lescurii Sull. - FALLS CO. Off highway 14 north of Bremond. 28 March 1941. Lundell & Lundell 10100.

Tortella humilis (Hedw.) Jenn. - NACOGDOCHES CO. Along brook off US 59 south of Nacogdoches. 22 March 1941. Lundell & Lundell 9754.

Weissia controversa Hedw. - DENTON CO. In woodland off US 77 near Lewisville. 3 May 1941. Lundell & Lundell 10433B. - NACOGDOCHES CO. In pineland off US 59 south of Nacogdoches. 22 March 1941. Lundell & Lundell 9748.

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The Distribution of North American Bryophytes
Dryptodon patens (Hedw.) Brid.

Dale H. Vitt [1] and René J. Belland [2]

Dryptodon patens is a monotypic genus belonging in the Grimmiaceae. Historically it has been placed in *Grimmia*, usually by European bryologists, where it's correct name must be *Grimmia curvata* (Brid.) De Sloover (Crundwell 1971), or in *Racomitrium*, usually by North Americans, where it's name is *Racomitrium patens* (Hedw.) Hueben. *Dryptodon patens* superficially resembles muticous species of *Racomitrium* in size and growth habit. *Dryptodon* shares features with species of *Racomitrium*, including relatively long setae, long sinuose basal leaf cells, rather large conic-mitrate calyptrae that are non-plicate, and a haplolepidous peristome of long linear, spinose-papillose teeth split about one-half the distance to the base. It also has similarity with some species of *Grimmia*, especially in the smooth, non-sinuose, more-or-less quadrate upper leaf cells and often upright, loosely tufted growth habit. However it also has several features that are either unique or very rare when compared with these two genera; these include ribbed capsules (rare in *Grimmia*), arcuate setae, especially when moist (uncommon in *Grimmia*), muticous leaves (also found in scattered species of both genera), and 2(3-4) ridges (lamellae) on the abaxial (dorsal) surface of the upper part of the leaves (unique to *Dryptodon*).

Dryptodon patens occurs on acidic or neutral rock surfaces. It is most common in moist, oceanic to montane, coniferous forests, but extends into mesic subalpine and low alpine tundra habitats. Ochyra & Szmajda (1990) reported it from high elevations in the European Alps (2400 m) and Honshu, Japan (3100 m). In western North America we have seen material collected from as high as 1800 m elevation. In the west, it occurs on mesic cliff faces and on mesic to exposed boulders and rock faces. *Dryptodon patens* grows in similar habitats in Newfoundland. It has been collected from near sea level to elevations of 660 m. The species is frequently found on siliceous rocks or boulders at the edge of streams or ponds in exposed or partly sheltered sites. *Dryptodon patens* is also known from early snowbed habitats. In it's habitat preferences, it is more similar to species of *Racomitrium* than to those of *Grimmia*.

The world distribution of *Dryptodon* has recently been mapped by Ochyra & Szmajda (1990). They reported a strongly disjunct, northern hemisphere range centered around the oceanic portions of northwestern Europe and western North America. In Europe, the species can be locally abundant in Scotland (the type locality) and

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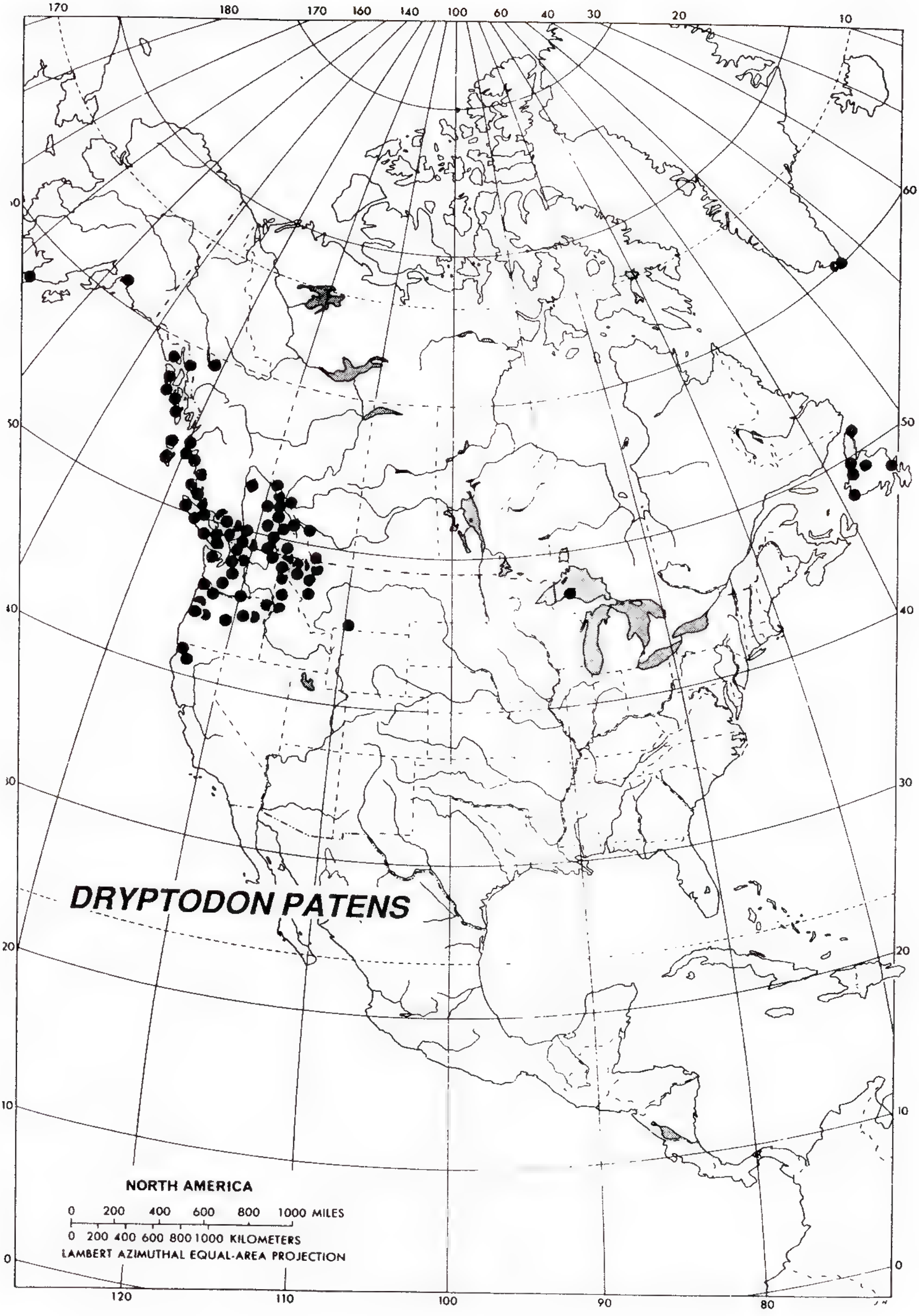

DRYPTODON PATENS

NORTH AMERICA
0 200 400 600 800 1000 MILES
0 200 400 600 800 1000 KILOMETERS
LAMBERT AZIMUTHAL EQUAL-AREA PROJECTION
170
180
170
160
140
100
60
40
30
20
10
60
50
40
30
20
10
0
120
110
100
90
80

Scandinavia and occurs as far south as Sardinia, the Canary Islands, and the Iberian Peninsula and east to the Carpathians and Latvia. It is known from the Altai Mountains in central Asia and from Japan.

The North American range is tricentric. In the west, it is widespread from southern coastal Alaska through northwestern British Columbia, continuing south and eastward to the interior mountains of British Columbia, and becoming rare on the eastern slopes of the Rocky Mountains of Alberta. It is common in suitable habitats in western Washington and northwestern Oregon, becoming more infrequent inland in the Rocky Mountains of northern Idaho and northwestern Montana. Farther south, it is known from two counties in northernmost California, including Del Norte Co. (*Duell 405/1aa* (ALTA). Field work in 1990 yielded the easternmost station in western North America in Carbon County, Montana (*Vitt 35456* ALTA). In the east it is known from disjunct occurrences in two counties on the Keweenaw Peninsula of Michigan (Crum & Anderson 1981) and from several stations on the island of Newfoundland, where it occurs mainly in the highlands of the west coast (map in Belland 1987). The species also has an isolated station near Port Blandford, on the northeastern coast of the island (Tuomikoski *et al.* 1973). It has also been reported from southernmost Greenland (*Hansen 67-329* ALTA) and from Iceland.

The occurrence of this species in Newfoundland and on the Keweenaw Peninsula of Michigan is similar to that of a number of species of bryophytes, including *Grimmia hartmannii* and *Timmia austriaca*. This distribution has been used to support the idea that these species survived at least some of the Pleistocene Glaciations in refugia in eastern North America (Steere 1938). Many of the species having this tricentric disjunction are calcicolous and it has been argued that this pattern of occurrence is edaphic, not historical. However it is interesting that *Dryptodon patens* is a decided acidophilous species. Belland (1987) presented an extensive discussion of the possibilities of survival of these species in eastern refugia versus their migration from western areas following the retreat of Wisconsinan glaciation. *Dryptodon patens* has an eastern North American distribution that might support either the idea of westward migration along a tundra corridor at the margin of the icesheet (Marie-Victorin 1938) or glacial survival of the species in this corridor and subsequent postglacial migration northward and contraction of range with the retreat of the ice sheet (Crum 1972; Given & Soper 1981). The latter hypothesis is generally favored and there is subfossil evidence to show that many species grew close to the southern edge of the ice sheet during the early postglacial (Miller 1980a, 1980b). However, there is as yet no subfossil evidence to show that these populations were the source for many of the disjunct populations in Newfoundland or elsewhere in the Gulf of St. Lawrence region. It is equally likely that *D. patens* and species with similar eastern North American distributions survived the glaciation in Gulf of St. Lawrence refugia. Some of these species (including *D. patens*) are ecologically associated with bryophytes whose distributions suggest a relictual glacial status, or have ecologies what would allow them to survive in such refugia.

Additional reports, new collections, and range extensions should be sent to the author. These new findings can be reported in future editions of this series.

NEXT SPECIES: *Ulota crispa* (Hedw.) Brid.

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The Rare Lichens Project
A Progress Report

Sherry K. Pittam [1]

The Rare Lichens Project is a study being conducted at the Department of Botany, Smithsonian Institution, in cooperation with The Nature Conservancy. The main goal of this project is to accumulate and organize data on the distribution and abundance of North American lichen species in order to generate a list of those lichens that may be rare and/or endangered. The criteria used to determine the conservation status are described here with a summary of progress to date.

Use of the Biological Conservation Data (BCD) system, designed by The Nature Conservancy and currently in use by many of the State Natural Heritage Inventory Programs, has been provided by the Conservancy. A database version of Egan's lichen checklist (Egan, 1987), with his revisions, provides the taxonomic classification for the project. As information is located or provided by outside sources, each of the taxa in the checklist is being evaluated to determine its conservation status. A preliminary status is assigned for those taxa that require additional analysis or data. Further documentation is maintained for those taxa with high priority status. The data are incorporated into the Conservancy's central scientific databases in Arlington, Virginia, and generally made available to heritage programs, government agencies, cooperators, and other interested parties.

In order to assess the conservation status of a lichen taxon, information is gathered from literature and herbarium collections. For species that appear to be rare this preliminary information is then supplemented with additional literature and collections review, field investigations, and personal communications, as time and resources allow.

The Conservancy's global ranking system (Morse, 1987) is used to determine conservation statuses. Status categories G1 through G5 are used, G1 meaning globally rare and most endangered, and G5 meaning widespread, abundant, and secure. The primary criteria used include geographic distribution (number of known extant sites, with notes on number of known extirpated sites, and global range) and global abundance. Additional criteria are taxonomic distinctness, methods of reproduction and dispersal, habitat requirements, and sensitivity to disturbance and pollutants. Recognizing that not all of these types of information will be known, or at best it will be incompletely known, the ranking system accounts and adjusts for uncertainties. Updates are ongoing. From these data, the high priority species will emerge as a list of rare lichens of North America.

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Progress in the project has been steady with several high points. Many individuals, from interested amateurs to professional botanists, have offered assistance. Several state heritage program botanists have shown interest and have made valuable contributions of information or offered to assist with field work. Data entry continues as information is received or located. Literature review is ongoing.

Contact with other lichenologists has also been an important source of information. Last March I visited with several enthusiastic lichenologists on the west coast who suggested many species for further study. In October 1990 I discussed the project with a group of U.S. Forest Service botanists, who are interested in obtaining information about rare cryptogamic species. Several persons have contributed in response to an AIBS poster I presented in Richmond, Virginia, in August 1990. Visitors to the Smithsonian often have helpful comments.

One objective of the project is to seek protection through various avenues for taxa that appear to be very rare. Shortly after beginning the project, enough information was obtained for several rare species to seek their protection. After reviewing this information for each of these species, Dr. Mason Hale and I wrote letters of nomination seeking Federal listing by the United States Fish and Wildlife Service (USFWS) for four of the species: *Phaeophyscia leana*, *Cladonia psoromica*, *Sulcaria isidiifera*, and *Gymnoderma lineare*. Three of these join *Cladonia perforata*, which A. Buckley and T. Hendrickson petitioned for listing (1988), as category 2 candidates in the *Federal Register* list published 21 February 1990. *Phaeophyscia leana* was not included in the list by USFWS, but has been renominated.

Documenting the current extant range and populations of rare and endangered species is a top priority for this project. Some difficulties in doing this are exemplified by the experience with *Gymnoderma lineare*. After unsuccessfully trying to relocate the species in the reported sites in western Maryland (Thomson, 1967), we reexamined the original specimens upon which those records were based and found them to be misidentified. Thus, the species is still known only from the Southern Appalachian Mountains (North Carolina and Tennessee) as mapped by Yoshimura & Sharp (1968). The currently known sites in North Carolina are being mapped and monitored by the state heritage botanist, Alan Weakley.

The state of California Resources Agency Natural Heritage recently informed me that they are going to monitor *Sulcaria isidiifera*. Site or population information about this lichen provided to me will be forwarded on to them to aid them in this effort.Persons working on state or local lichen floras can be of assistance by notifying me of interest in sharing information about species' ranges and abundance. Reprints of pertinent articles are also very helpful, especially if published in "local" publications. The original reprint will be filed in the Smithsonian's lichen reprint collection for use by other researchers. I recently circulated a list of some species for which additional distributional data is needed. Within the next year I hope to distribute a preliminary list of rare or endangered lichen taxa for comment. If you wish to be added to that mailing list please notify me.

When sending names of suggested species it would be helpful to provide as much of the following sort of information as is known:

Name of Taxon: ______________________________
Number of currently known populations rangewide: _______
Documentation of sites (if very rare)________________
Abundance at known sites: ______________________
Taxonomic status: Questionable ________ Stable ____
Known threats: ______________________________
Comments:__________________________________
Literature and information sources: ______________

Before his untimely death, Dr. Mason Hale was enthusiastic about the importance of this project and provided important advice and assistance. The completion of this project will be a memorial to his concern for the environment.

Acknowledgements. Thank-you to Drs. Laurence Skog and Harold Robinson, The Smithsonian, for allowing me time and resources for this project. Much gratitude is owed to Dr. Larry Morse of The Nature Conservancy for his continuing support, and his energetic networking of information between many individuals and organizations. Thanks to Drs. Lois Brako and Irwin Brodo for reading this paper and offering many helpful suggestions. A special thanks to all the individuals who have offered species names, suggestions and information.

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Hepatics Collected at the Eighth Midwest Bryological & Lichenological Foray

Stephen L. Timme [1]

Twenty-five taxa of hepatics were collected at the Eighth Midwest Bryological & Lichenological Foray held at Big Spring National Park, a part of the Ozark Scenic National Riverways in Carter County, Missouri. Twelve of the twenty-five taxa are reported as new county records for Missouri. Collections were made along the river and bluffs at Big Springs in Carter County and along the falls, bluffs, and upper slopes of Rocky Creek Falls in Shannon County. Specimens are deposited in KSP and duplicates have been sent to MO. An asterisk preceding a county name (in parentheses) indicates a first report for the county. All collection numbers are mine.

Aneura pinguis (L) Dum. - on moist decorticated log and moist soil over dolomite. 9888 (*Carter); 9898 (Shannon). This species was first reported from Grasshopper Hollow Fen in Reynolds County and Blair Creek Raised Fen in Shannon County (Vitt & Horton 1990), but a specimen collected by Redfearn (18381) from Jefferson County was in the SMSU herbarium in 1983 under the synonym *Riccardia pinguis* (L.) S. Gray.

Calypogeia fissa (L.) Raddi; on shaded soil at base of *Osmunda regalis* var. *spectabilis* (Willd.) A. Gray. 9899 (*Shannon).

Cephaloziella rubella (Nees) Warnst.; on moist soil over rock of west slope. 9896 (Shannon).

Cololejeunea biddlecomiae (Aust.) Evans; in rock crevice on east side of slope. 9891 (Shannon).

Conocephalum conicum (L.) Lindb.; on dolomite and chert boulders, vertical rock, and soil along stream. 9873 (Carter); 9902 (*Shannon).

Frullania eboracensis Gott.; on log. 9892 (Carter).

Frullania inflata Gott. on base of *Carpinus caroliniana* Walt., *Platanus occidentalis* L., *Juniperus virginiana* L., and on rocks. 9870, 9889 (Carter); 9901, 9907 (Shannon).

Frullania riparia Hampe ex Lehm.; on bark. 9881 (Carter).

Frullania squarrosa (Reinw. et al.) Dum.; on moist rocks at edge of spring, on bark at base of *Asimina triloba* (L.) Dunal, and shaded rocks. 9862, 9865, 9868, 9875 (Carter); 9892 (Shannon).

Jubula pennsylvanica (Steph.) Evans; on wet rock near spring. 9885 (*Carter).

Leucolejeunea clypeata (Schwein.) Evans; on thin soil over rock below overhang. 9905 (Shannon).

Lophocolea bidentata (L.) Dum.; on rocks at edge of spring. 9877, 9880, 9887 (*Carter).

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Lophocolea cuspidata (Nees) Limpr.; on moist shaded rock at edge of stream. 9874 (*Carter).

Lophocolea heterophylla (Schrad.) Dum.; on soil over roots just above water line of stream above falls. 9904 (*Shannon).

Mannia triandra (Scop.) Grolle; on exposed soil of upper slope. 9894 (*Shannon).

Metzgeria furcata (L.) Dum.; attached to wet rock near spring. 9886 (*Carter).

Nowellia curvifolia (Dicks.) Mitt.; on wet decorticated log in woods north of path leading to spring. 9884 (*Carter). This species has been reported only from one other county (Dallas).

Plagiochila asplenioides subsp. *porelloides* (Torrey ex Nees) Schust.; on boulders near spring mouth. 9871 (Carter)

Porella pinnata L.; on rocks and roots at edge of stream, submerged. 9860, 9867 (Carter); 9903, 9910 (Shannon).

Porella platyphylloidea (Schwein.) Lindb.; on bark at the base of *Asimina triloba* (L.) Dunal. 9864 (Carter).

Porella platyphylla (L.) Pfeiff.; on moist shaded rock on east side of upper slopes. 9893 (Shannon).

Radula obconica Sull.; on shaded boulders near spring. 9878 (Carter).

Reboulia hemisphaerica (L.) Raddi; on boulders near edge of stream. 9874 (Carter).

Riccardia multifida (L.) S. Gray; attached to boulders, submerged. 9869 (*Carter). This specimen was collected by Bruce Allen and given to the author for identification.

Trichocolea tomentella (Ehrh.) Dum.; on boulders near spring mouth. 9872 (*Carter).

The new county records mentioned above indicates that the hepatic flora of Missouri is not well documented. Most of what is known can be attributed to the bryophyte studies of Redfearn (1960, 1961, 1962, 1963, 1964, 1970, 1976,1981). A thesis by Thomas (1974) provides a good review of the hepatics of the Interior Highlands, but did not provide county distributions. Further and more detailed studies of the hepatic flora of Missouri is needed to provide a better understanding of the taxa present and their distribution.

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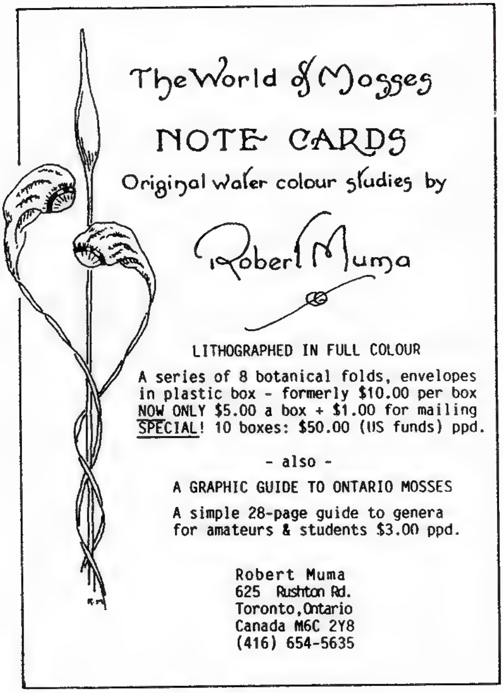

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Palludella Rediscovered in New York

F. Robert Wesley [1] and Nancy G. Slack [2]

Paludella squarrosa (Hedw.) Brid. not collected in New York or the contiguous states since the nineteenth century, was found near Hamlton in Madison County, NY by us (Slack & Wesley 5325, Acc # 1299) on August 25, 1989. Charles Horton Peck, later the first New York State Botanist, had collected it in Jordanville in Herkimer County, NY in 1867. C. F. Austin's exsiccatae collections (Musci Appalachiani Supplement 1) from this site are in many American herbaria. *Paludella* has been searched for but not found in the vicinity of Jordanville. There is also mention by Peck in his 1867 report to the New York State Regents of a collection from the town of Arcadia, Wayne Co., NY, but this specimen has not been found. The Jordanville collections were from pure stands of *Paludella*, quite extensive judging from the number of collections we have seen from three New York herbaria and elsewhere. At the Madison County site, however, *Paludella* is sparsely distributed in mixtures of many species of both bryophytes and vascular plants on the sides of small hummocks in a rich fen. The hummocks are on the shore of a marl pond. Species found with *Paludella* include *Sphagnum warnstorfii, Campylium stellatum, Aulocomnium palustre, Plagiomnium ellipticum* and *Bryum pseudotriquetrum*, all occurring in a 10X10 cm plot on one of the *Paludella* hummocks. Also occurring on the same plot were *Vaccinium oxycoccus, Drosera rotundifolia, Cornus stolonifera, Theylpteris palustris, Aster borealis, Galium labradoricum, Carex aquatilis,* and *Lycopus uniflorus*. *Paludella* was found in small strands and extensive searching located only a few other hummocks containing *Paludella*, all within a few square meters.

This discovery was made in the course of quantitative research on fens sponsored by the New York Heritage Program. Other bryophyte species, currently rare or endangered in New York State, are also present in these fens; these include *Meesia triquetra, Cinclidium stygium* and *Sphagnum subfulvum*. It is possible that with a new "search image", i.e. small strands growing among many other species, additional sites may be found for *Paludella* in New York or adjacent states. Madison County, NY appears to be the southernmost site for *Paludella squarrosa*, a circumboreal species, in the eastern United States. A survey of a number of herbaria (NYS, CU, NY, VT, MICH, CANM) located specimens from Alger, Keweenah and Montcalm Counties, Michigan and from Brownington in Orleans County, Vermont, from Minnesota, from Cape Breton Island, Nova Scotia, and the Bruce Peninsula, Ontario. Other eastern North American specimens were from far northern areas of Ontario and Quebec.

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Dicranodontium denudatum and *Mnium cinclidioides* New to Maryland

Lloyd R. Stark [1]

During a pre-mining survey of the vegetation in a wetland system along Cherry Creek in Garrett County, Maryland, two species previously unrecorded for the state of Maryland were recovered. Both species are expected to occur in this region based on their overall distributions.

Mnium cinclidioides Hüb. Maryland, Garrett Co., Cherry Creek drainage between Accident and Bittinger. Stark & Wenerick 84-08-287 (PAC)

Garrett County, Maryland is near the southern edge of the known distribution of *M. cinclidioides*, which extends in eastern North America from Newfoundland to two locations in Virginia. However, its distribution south of New York is spotty, with only a few reports from Pennsylvania. This species usually occurs on moist soils in swampy habitats (Crum & Anderson 1981).

Dicranodontium denudatum (Brid.) E. G. Britt. *ex* Williams. Maryland, Garrett Co., Cherry Creek drainage between Accident and Bittinger. Stark & Wenerick 84-08-293 (MO, PAC), 84-08-295 (PAC), 84-08-386 (PAC).

The North American distribution of *D. denudatum* is more encompassing, stretching from Maine to Georgia and Alabama, but restricted to the Appalachians south of New York. This Maryland station is thus not surprising. *Dicranodontium denudatum* is a species of damp or wet places, not restricted to bogs (Crum & Anderson 1981).

I thank Dr. Bruce H. Allen for the identification of the *Dicranodontium,* Messrs. John R. Kunsman, William R. Wenerick, and Ed Thompson for assistance in the field, and the Maryland Department of Natural Resources, Bureau of Mines, for sponsoring the survey.

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Rhizomnium gracile and *R. andrewsianum* in Arctic Alaska

Robert Wyatt and Ann Stoneburner [1]

In the course of our continuing systematic and evolutionary studies of the Mniaceae, we sampled populations of *Rhizomnium* from the vicinity of the Toolik Lake Field Station operated by the Institute of Arctic Biology of the University of Alaska. This site is on the Dalton Highway, in the northern foothills of the Brooks Range and about 200 km south of the Arctic Ocean at Prudhoe Bay. The area is dominated by arctic tundra vegetation with alpine tundra on the steep slopes of surrounding mountains.

We were surprised to discover around the margins of Toolik Lake *R. gracile*, a boreal moss previously believed to occur only south of the Arctic Circle. In describing this species, Koponen (1973) stated that "*R. gracile* seems to be strictly boreal in nature and absent from the arctic zones proper." His distribution map showed only one Alaskan site for *R. gracile*, from Mt. McKinley National Park (63°25'N). Similarly, Steere (1978) considered *R. gracile* "a truly subarctic species which extends south as far as northern Michigan, but does not reach Arctic Alaska at its northern limit."

In contrast, *R. andrewsianum* belongs to Steere's (1965) "circumpolar, high-arctic element." To clarify the range of this taxon, which originally included *R. gracile* [in Steere's (1958) *Mnium andrewsianum*] as well as *R. andrewsianum* sensu stricto, both Koponen (1977) and Steere (1978) published maps of its total known geographical distribution. All sites in Alaska were north of the Arctic Circle. In mountainous regions, however, it extends as far south as Alberta in North America and the Sayan Mountains in central Asia, both just north of 50°N (Koponen, 1977; Steere, 1978).

Having found *R. gracile* on the North Slope, we decided to reexamine all of the specimens of *Rhizomnium* in the University of Alaska Herbarium (ALA). We discovered two specimens (Steere 16221 and Lewis 1709), labelled "*Mnium andrewsianum*," that were in fact *R. gracile* from north of the Arctic Circle. As our map shows (Fig. 1), it is now clear that *R. gracile* does occur in arctic Alaska. On the other hand, *R. andrewsianum* does indeed appear to be restricted in Alaska to sites north of 67°N (Fig. 1). It should be noted, however, that it is unlikely that these two species will be found in mixed stands, as their habitats differ quite dramatically. In keeping with Koponen's (1973) and Steere's (1978) ecological descriptions, we found *R. andrewsianum* in upland, rocky sites, where the plants occurred in small patches on wet soil in depressions around isolated boulders. In contrast, *R. gracile* occurred on vertical, peaty walls of depressions (possibly caused by caribou) in wet tundra at the margins of Toolik Lake. These habitats are so distinct that it is difficult to imagine their intergrading sufficiently to permit close intermingling of these species. Thus, although we have now shown that the ranges of these taxa overlap in arctic Alaska, the possibility of the type specimen [from drainage channels on a steep north-facing slope in the Schrader Lake - Peters Lake area] being *R. gracile* or a mixture of both species can be discounted. Fortunately, this possibility has been rejected anyway by Koponen's (1979) careful study of the type.

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Specimens cited. Voucher specimens of all our collections are deposited in ALA.

Rhizomnium gracile. Alaska. Toolik Lake at Milepost 285 on the Dalton Highway. On vertical, peaty soil at edge of a depression, lake margin, Stoneburner & Wyatt 5151. Gubic and vicinity, near the confluence of the Chandler and Colville Rivers, approx. 69°28'N. Lat., 151°30'W. Long. Wet tundra, W.C. Steere 16221. Along Ruby Creek, 1 mile S. of Bornite, ca. 67°03'N., 156°56'W. Brushy Willow bog along the creek and in the valley, M. Lewis 1709. *Rhizomnium andrewsianum*. Alaska. Atigun Valley at Milepost 255 on the Dalton Highway. On wet soil in depressions about boulders in alpine tundra, Stoneburner & Wyatt 5149. Flank of "Mt. Steere" at Milepost 276 on the Dalton Highway. On wet soil in depressions mostly associated with isolated boulders in seepage areas, Stoneburner & Wyatt 5152.

Acknowledgments. We thank B. M. Murray for encouragement and help, M. Abels and D. Witt of the Institute of Arctic Biology for logistical support, and D. Grisé for assistance in processing specimens. We also thank the National Science Foundation for a grant in support of our work on the Mniaceae (BSR-8806386).

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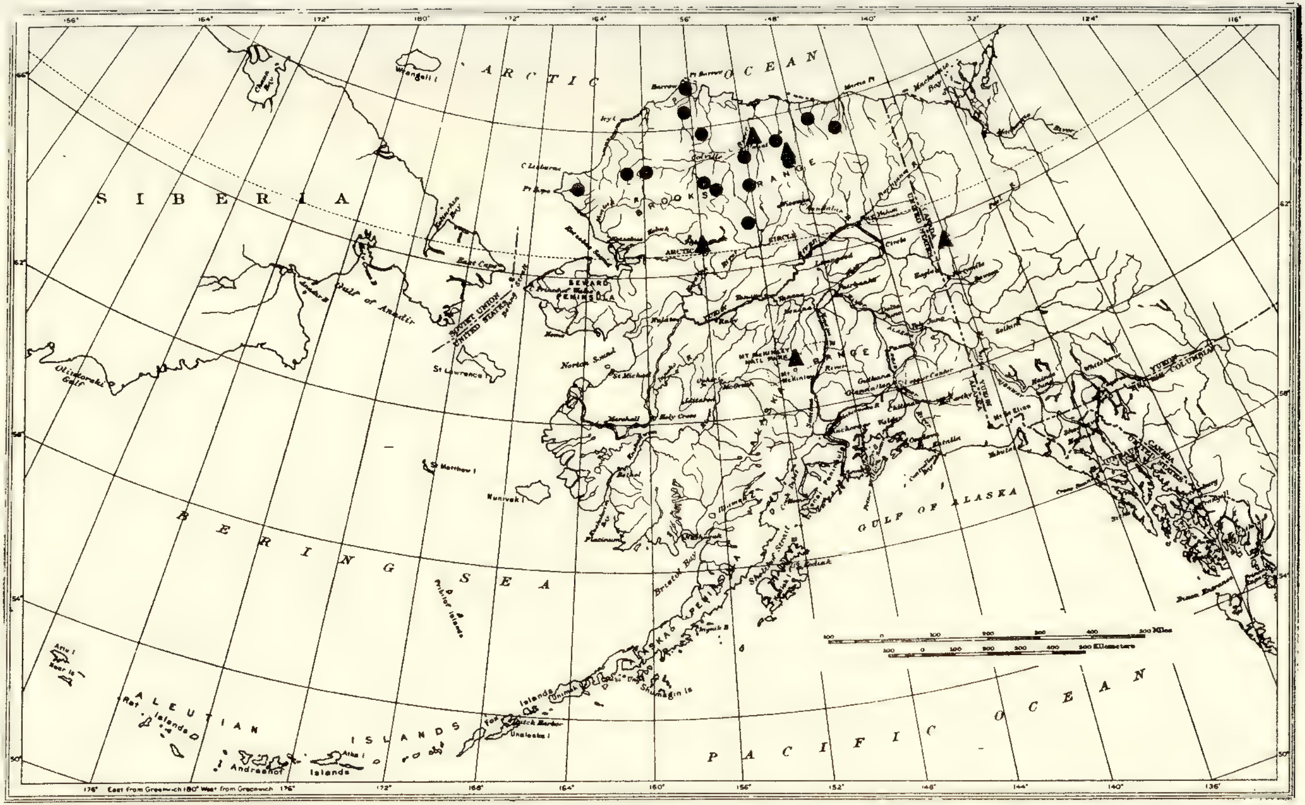

Figure 1. The distribution of *Rhizomnium andrewsianum* (dots) and *R. gracile* (triangles) in Alaska, based on specimens at ALA. Note that *R. andrewsianum* occurs only north of the Arctic Circle, with most sites on the North Slope of the Brooks Range. In contrast, *R. gracile* ranges farther south.

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A History of Developmental Studies of Peristomes

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Moss peristomes and systematics.

Since the time of Hedwig in the late eighteenth century, peristomial characters have been fundamental to moss systematics. Despite possible differences in habitat, life history, and morphology of the gametophyte, similarities in peristome structure have been used to establish evolutionary relationships and develop taxonomic systems. As Philibert stated in the late nineteenth century: "It is extremely probable that all species having almost identical peristomes have a common origin....It is impossible to see how a structure as complex and as uniform as the peristome could be produced identically in species with lines of descent independent of each other" (Philibert 1884a,b, 1888, as translated by Taylor 1962).

Despite the great importance of peristomes to moss systematics, the development of these structures has been examined in only a limited number of taxa. Furthermore, few taxa lacking peristomes have been examined until recently. Precise developmental information from a broad spectrum of taxa is needed before evolutionary relationships can be established based on peristomes. The goal of this paper is to stimulate further interest in developmental research by reviewing the history of study of this important structure.

Growth and Development of the Moss Sporophyte

In all mosses, early cell divisions separate the central region of the sporophyte, the endothecium, from the amphithecium. The endothecium gives rise to the columella and the sporogenous layer, while the amphithecium differentiates into the outer spore sac, capsule wall, peristome teeth, and operculum. With one known exception (Stone 1961), the spore sac, derived from the innermost layer of the amphithecium, is the boundary between the amphithecium and endothecium. However, since few mosses have been examined in detail, this is, as Proskauer stated: "an article of bryological faith subject to query" (Proskauer 1958).

The peristome teeth are found in one or two rings surrounding the mouth of the capsule. They are frequently 16 in number, as in *Funaria*, but there can be as many as 32 or 64 teeth in other taxa. In taxa such as *Physcomitrium* the teeth are entirely

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lacking, and therefore the capsule is said to be gymnostomous. Peristome teeth can be described as being either nematodontous or arthrodontous, depending on the number of cell layers and the particular cell walls involved in peristome tooth formation. Nematodontous peristomes are composed of several layers of cells all with thickened, periclinal and anticlinal walls. Arthrodontous peristome teeth, in contrast, consist of only a single or double ring of thickened periclinal cell wall remnants at maturity. This major difference was first noted by Lantzius-Beninga (1850), and was reflected in the classification system of Mitten (1859). Arthrodontous peristomes in turn can be further divided into either haplolepideous or diplolepideous types. These terms, first introduced by Philibert (in Taylor 1962), describe the number of cell wall remnants that can be seen on the outer surface of each tooth. On the external surface of the teeth of haplolepideous taxa, only a single vertical row of cell wall remnants is present, while in diplolepideous taxa two vertical rows of cell wall remnants are visible on the outer teeth. Therefore, a vertical line can be seen running down the surface of the outer teeth of diplolepideous taxa. These differences reflect the number of cells in the layers which give rise to the peristome teeth.

Diplolepideous moss peristomes have been divided into two major types. *Funaria*-type peristomes, known only from the Funariales, consist always of 16 teeth. The exostome (outer) teeth are always directly opposite the endostome (inner) segments (See Fig 1). *Bryum*-type peristomes have 16 teeth, but the exostome teeth always alternate with the endostome segments. As will be explained later, surface ornamentation of the endostome segments is similar to those of the haplolepideous peristome teeth.

The three innermost layers of the amphithecium, distal to the annulus, give rise to the peristome teeth. These have been designated the inner peristomial layer, primary peristomial layer, and outer peristomial layer (see Fig. 1: A,C); IPL, PPL, OPL, respectively (Blomquist & Robertson 1941). Although these layers were recognized almost a century earlier (Lantzius-Beninga 1850, Kienitz-Gerloff 1878), no specific terminology was developed at that time. As will be described later, the outer peristome (exostome) develops from the paired cell wall-remnants between the OPL and PPL. The endostome develops from the paired cell walls between the PPL and IPL.

In order to describe the cells responsible for peristome differentiation more precisely, Edwards (1979, 1984) has suggested a formula based on the number of cells in one eighth of the circumference of the capsule (see also Shaw & Robinson 1984). Beginning with the number of cells in the OPL, the number of cells in each of the successive peristomial layers are represented. For example, the formula for the *Funaria*-type peristome is 4:2:4; See Fig. 1 B (Shaw & Robinson 1984). There are therefore four OPL cells adjacent to two PPL cells, which are opposite four IPL cells. *Bryum*-type peristomes can also have a 4:2:4 formula, however the cells forming the

IPL are not radially aligned with those in the PPL and OPL. Edwards (1979) suggested a "z" to denote opposite segments (for *zusammen*, next to each other), and a "C" to denote alternate segments. These terms are seldom used, however.

Developmental Studies of Peristomes

The earliest description of moss capsule development is that of Valentine (1833). He clearly explained that the sporophyte grows from an apical cell, followed by elongation of the seta. It was unknown at that time that the sporophyte generation was the product of fertilization of a haploid egg. Although it was not to be proven by Hofmeister until 1865 (Goebel 1926) that the sporophyte was the result of fertilization, a similar idea had been proposed by Hedwig (Florshutz 1960). In January 1774 Hedwig suggested that the capsule was more like the fruit of a higher plant. The prevailing idea at the time was that the capsule was equivalent to the anther of a flowering plant.

No clear explanation of all cell divisions leading to the formation of the capsule was given by Valentine. His observations of the apical cell of the sporophyte and of the organization of distal cells of the sporophyte were remarkably accurate for that time. His more detailed observations became possible as optical microscopy was improved. Valentine was fortunate in being able to obtain, in 1831, a very good microscope from the instrument-maker Ross. This instrument incorporated an advanced design of sub-stage condenser, then rarely used in Europe. The microscope also had compound achromatic objectives of numerical aperture 0.19 (Bradbury 1967).

Valentine further suggested that the operculum divides giving rise to the peristomial layer on the interior. The peristomial layer reportedly split longitudinally, forming the individual teeth. Beyond this, no developmental information was given by Valentine. Also clearly understood in the 1830's was the fact that the cell layer which forms the endostome if followed precisely, is continuous with the outer spore sac. Furthermore, the peristome teeth were known always to be in multiples of four.

A precise and far more detailed description of sporophyte anatomy can be found in the outstanding account of Lantzius-Beninga (1850). Examining mature capsules, Lantzius-Beninga showed for the first time that the peristome of most mosses is composed of cell wall remnants. The cells which form the peristome are organized into vertical files, which are actually concentric cylinders of cells forming the apex of the sporophyte. A regular sequence of cell divisions must take place at the apex to give rise to such a well-organized structure. Lantzius-Beninga demonstrated that the three innermost cell-layers of the amphithecium are those that form the peristome. Specifically, the inner surface of the OPL, both the inner and outer walls of the PPL, and the outer surface of the IPL all show depositions of secondary thickening. The two outer surfaces show one type of thickening while the two inner surfaces show another type.

Furthermore, Lantzius-Beninga demonstrated that, although the exostome of the Diplolepidae is superficially similar to the single peristome of the Haplolepidae, it is fundamentally different, as it is formed from different layers of cells. It is the endostome which is formed from the same cell layers as the haplolepideous peristome. Another major discovery was that the peristomes of *Polytrichum* and *Tetraphis* are very different in that their peristomes are composed of several layers of whole cells, while other mosses have only a portion of the cell wall forming each tooth. These two groups are now known as the Nematodontae and the Arthrodontae respectively. Lantzius-Beninga, however, did not stress either of these important differences. Although his study covered 18 genera and provided excellent information about the structure of the mature peristome, no developmental information was provided about the sequence of cell divisions which gives rise to the peristomial layers.

Hofmeister (1862) was the first to describe early growth, segmentation, and cell division patterns in the sporophytes of mosses. Examining *Funaria*, he found that apical cell segments are formed by inclined transverse divisions cutting off segments from a two sided apical cell. The segments are arranged in two vertical files on opposite sides of the sporophyte axis. The first division within each segment is radial and divides the segment into two equal cells. The next division is periclinal, and forms an inner and an outer cell from each of the two cells forming the segment. The inner cell differentiates to form the endothecium, while the outer cell forms the amphithecium. The third division of each segment is transverse, and results in a segment with proximal and distal halves. In all taxa examined by Hofmeister, including those with more elaborate peristomes, such as *Funaria*, the periclinal division is always seen to precede the transverse divisions of the segment.

At this stage, according to Hofmeister, reduced taxa, such as *Phascum*, begin a series of transverse divisions which do not occur in larger mosses. Further development within the individual segments and the differentiation of the peristome teeth are not described, other than that they are formed as the result of alternating periclinal and anticlinal divisions. The remainder of Hofmeister's observations concern spore differentiation, growth of the vaginula, and other portions of sporophyte development not related to peristome formation. Older spear stages, and mature capsules are included as illustrations, however.

The magnificent paper of Keinitz-Gerloff (1878) was the first to give a detailed account of the development of the peristomial region, from the early embryo to the mature capsule. The emphasis of that paper was the development of the entire moss capsule, and not specifically upon the peristome. Only arthrodontous peristomes were examined, and most of the observations were of *Ceratodon*. The description of the early development of *Funaria* was identical to that of Hofmeister. Numerous illustrations show both cross and longitudial sections of developing sporophyte apices, and the apical cell and developing segments are clearly visible. The description of the actual sequence of divisions as seen in cross section shows that an alternating series of periclinal and anticlinal divisions takes place, until six amphithecial layers are present. No later divisions of the IPL, reported by other workers (Evans & Hooker 1913), are noted. The peristome is reported to differentiate from the three innermost layers of the amphithecium. The sporogenous layer is differentiated from the outermost layer of the endothecium. The endothecium divides in the same manner as the early stages of growth of the amphithecium.

Kienitz-Gerloff's description of the development of *Phascum* differs from that of Hofmeister. The second division in each segment is oblique anticlinal, and divides each quadrant into a four-sided cell and a three-sided cell. The next division is at right angles to the previous one, and results in an inner cell surrounded by two outer amphithecial cells. "This is how Kuhn's fundamental quadrants are formed" (Kienitz-Gerloff 1878, Kuhn 1870). Aside from this division, the remainder of development is as Hofmeister described. The same series of oblique anticlinal walls are observed in the early development of *Ceratodon*, and in the first divisions of the endothecium in many other taxa.

Although the numerous illustrations accompanying Kienitz-Gerloff's paper show surface and longitudinal views of segmentation, these are not discussed beyond the first few divisions within each segment. Clearly Keinitz-Gerloff recognized that the inner three files of cells would differentiate into the peristome, while the outer three would form the operculum. He also illustrated that the IPL (the innermost layer of the amphithecium) is continuous with the spore sac. Late maturation of the capsule is also discussed in detail in relation to formation of the air space which surrounds the spore sac, and the formation of the trabeculae that traverse it. No mention is made by Kienitz-Gerloff of the thickening of the cell walls which will form the peristome teeth. Continuity of the IPL with the spore sac was not to be emphasized or discussed for almost 100 years, until Kreulen (1972) once again confirmed the continuity of this cell layer.

Vaisey (1888) also reported that oblique anticlinal walls were observed in the development of *Polytrichum*. He describes in detail the early sequence of divisions at the sporophyte apex, and clearly illustrates the development of the amphithecial layers. He was influenced by the work of Kienitz-Gerloff (1878), however, because one of the illustrations of the oblique anticlinal division is credited to Kienitz-Gerloff (1878). Vaisey (1888) also describes an additional anticlinal division in the first amphithecial layer, which doubles the number of cells in each subsequent layer of amphithecium. This is a fundamental difference in the development of the peristome of *Polytrichum* (confirmed in recent studies of the Polytrichaceae by Mishler, Anderson & Shaw, in press).

Sachs (1887) included a description of the development of the moss capsule in his *Textbook of Botany*. However, his description of development is more correctly called maturation than development because Sachs begins his description at the completion of cell division at the apex. The peristome is correctly identified as being derived from the three innermost layers of the amphithecium. The OPL, PPL, and IPL are identified in illustrations, but are not given specific names. Sachs also showed that the IPL is continuous with the outer spore sac, and that the PPL is distal to the air space in the capsule. In terms of development, dehiscence of the capsule takes place first, followed by dissolution of the parenchyma between the columella and the peristome teeth. The mature peristome teeth split apart longitudially, the number of teeth being equal to the number of PPL cells. At maturity the teeth consist only of cell-wall remnants.

Additional information was published by Goebel (1905) in his textbook. The first cell divisions in each segment are as Kienitz-Gerloff reported. However, Goebel (1905) suggested that the third division in each segment is anticlinal in some mosses and periclinal in *Funaria* and *Ephemerum*. He stated: "Little weight is to be attached to the succession of cell divisions; the same result can be obtained by more than one sequence of division". Further development is described as a series of periclinal and anticlinal divisions, similar to those reported by Sachs. (See Saito (1956) and Saito & Shimoze (1954) for a description of a similar periclinal division early in the development of *Bartramia*.) The illustrations that accompany Goebel's description provide additional information. Each ring of amphithecium can be seen to have half as many cells as the ring external to it. The most mature stage of development illustrated for *Funaria* is one with a three layer amphithecium. A very fine illustration of *Nanomitrium*, a cleistocarpous moss, is included but not discussed.

Although written only seven years after the work of Goebel, Campbell (1913) fills in some of the gap between the early stages already described, and the mature stages described by Lantzius-Beninga (1850). After the initial division separating the amphithecium and endothecium, Campbell describes in detail the divisions of the sporogenous layers. He illustrated, but did not discuss, the developing amphithecium. The early development of *Ephemerum*, including the separation of amphithecium and endothecium is identical with that of *Funaria*. *Phascum* development is similar, but not identical in the peristomial region. Similar to the descriptions of Keinitz-Gerloff (1878), the second division in each segment is oblique rather than periclinal, as in *Funaria*. Futhermore, an amphithecium of only four layers is present at maturity. Neither peristome teeth nor an annulus differentiates later in development.

Unfortunately, Campbell's illustrations are not cross sections of embryos of different ages, rather these are a series of cross sections of a single developing sporophyte. It is assumed that the earliest stages of development are to be found in the most distal part of the seta. Other illustrations show mature capsules but do not describe the development of the peristomial layers. The peristome of *Funaria* is said by Campbell to differentiate from the fifth ring of cells in from the surface of the capsule, and consists of a single thickened cell wall, with the tangential walls also thickened. The operculum is derived from the surface layer of the capsule, and swells greatly at the time of maturity. The sporogenous layer was also described as a cylindrical layer not overarching the columella, as it does in *Andreaea* or *Sphagnum* (De Bary 1884, Goebel 1905, Sachs 1887).

One of the first papers to reflect the important contribution of Philibert (Taylor 1962) was the description of the development of *Ceratodon*, a haplolepideous moss, by Evans & Hooker (1913). Their meticulous description follows development from the first division of the apex, until deposition of the peristomial thickenings. Although they describe the segmentation pattern of the apex, only cross sectional views are discussed.

Evans & Hooker described the early cell division patterns as reported by previous workers. Each of the cells of the amphithecium divides anticlinally, followed by a periclinal division. This results in a two layered amphithecium. Next the outer layer divides anticlinally, and then periclinally once again. Therefore, each ring of cells contains twice as many cells as the one immediately interior to it. In this way a six-layered amphithecium is formed. The innermost layer was designated the inner peristomial layer, while the next external layer was called the outer peristomial layer. (Present day terminology would designate the latter as PPL.) This difference in terminology is understandable because Evans & Hooker were examining a haplolepideous moss. Later in development the IPL divides unequally twice in an anticlinal plane, resulting in three cells of the IPL being opposite each pair of PPL cells. Transverse divisions in each of the segments also occur "in a rather indefinate way and vary in different parts of the capsule".

This was the first "modern" description of the development of a haplolepideous peristome, and it explained why each tooth has a smooth outer surface, and a line on its inner surface. Citing Philibert, the single peristome of *Ceratodon* is explained as homologous to the inner peristome, or endostome, of a diplolepideous moss. The haplolepideous peristome teeth show the cell wall patterns seen on the surfaces of the endostome teeth. According to Evans & Hooker, deposition begins in the IPL and later takes place in the PPL. No deposition is reported for the OPL.

Van der Wijk (1929), Lorch (1931), and Wenderoth (1931) published detailed descriptions of the development of the capsule of *Polytrichum* (these have been expanded upon in a forthcoming paper by Mishler, Anderson & Shaw, in press). Early development of the sporophyte of *Polytrichum* is similar to that of other arthrodontous mosses. A two-sided apical cell cuts off derivatives, forming two vertical files of segments. The first division of each segment is anticlinal, forming the quadrant stage reported throughout the literature, The second division within each segment is reported by Lorch (1931) as oblique anticlinal. Wenderoth (1931) however, describes this division as periclinal, separating the amphithecium from the endothecium. Both authors report the next two divisions to be anticlinal, resulting in four amphithecial cells in each quadrant. In all other mosses only one anticlinal division follows the periclinal division. As a result of this additional anticlinal division, there are twice as many cells in each layer of the amphithecium of *Polytrichum* as there are in any of the other taxa previously described.

Development proceeds from this point on as an alternating series of periclinal and anticlinal divisions until six layers of amphithecium are formed. All of the anticlinal walls of the amphithecium are aligned radially, and therefore all of the cells in the peristomial layers are opposite (Van der Wijk 1929). The peristome teeth are formed from the thickened anticlinal and periclinal walls of the four innermost amphithecial layers (Lorch 1931, Wenderoth 1931). At maturity the teeth are only five cells in height; late in development the peristome-forming cells become stretched into a remarkable U-shaped configuration. As in arthrodontous mosses, however, the innermost layer of the amphithecium forms two layers where it is continuous with the outer spore sac (Van der Wijk 1929, Lorch 1931).

One of the most complete and frequently cited papers is that describing the peristome of *Aulacomnium heterostichum* by Blomquist & Robertson (1941), based on a thesis by Robertson (1932). Cell division planes, as seen in cross section, of *Aulacomnium*, a diplolepideous moss, are almost exactly the same as those seen by Evans & Hooker (1913) for *Ceratodon*. However, the divisions of the IPL are different later in development. Eight cells of the IPL are adjacent to each pair of PPL cells, while fewer were present in *Ceratodon*. Furthermore in *Aulacomnium*, cells of the IPL divide asymmetrically, here resulting in one large and one small cell. The larger cell will later divide to give the final 4:2:3 peristomial formula. The timing of all these important later divisions was also given for the first time. After the conclusion of cell divisions the PPL cells swell greatly, causing a keeled arrangement of the inner peristome. No such keel is seen in either *Funaria* or *Ceratodon* (Smith 1955). Blomquist & Robertson also related cell division patterns to the patterns of cell wall remnants seen on the inner and outer surfaces of the peristome teeth. Although this was mentioned by Philibert, Blomquist & Robertson provided a much more precise description, along with illustrations.

A complete sequence of cell divisions leading to the formation of the peristome in *Funaria*, as seen in cross section, was given by Smith (1955), Proskauer (1958), and Shaw, Anderson & Mishler (1989). The discussions and terminology in these papers followed the format of Blomquist & Robertson; no information about segmentation or development of the embryo was given. Schwartz (1989) provided the latter information for several taxa in the Funariales, including *Funaria*. While early cell divisions leading to the formation of the peristome are exactly as reported by Evans & Hooker (1913), and Blomquist & Robertson (1941), the third cell division is oblique anticlinal, dividing each quadrant into two irregularly shaped cells. This was as described for *Phascum* (Keinitz-Gerloff 1878, Campbell 1905). Later divisions of the IPL, as reported by Blomquist & Robertson, are also different from those reported by previous authors. Late divisions of the IPL result in a 4:2:4 peristomial formula, with all periclinal walls aligned radially. As a result, the inner and outer peristome teeth are directly opposite each other, unlike other diplolepideous mosses. (A similar pattern is found in the development of the peristome of *Discelium* see Shaw & Allen (1985)). At maturity the teeth of *Funaria* are steeply spiralled and taper to narrow points near the apex (Shaw, Anderson & Mishler 1989). This is not apparent from previous studies of this taxon (Sachs 1887, Goebel 1905, Smith 1955, Proskauer 1958).

The development of *Mittenia* differs from that of all other mosses so far investigated (Stone 1961). Early divisions within the segments are as reported by previous workers. Stone reported, as did von Goebel, and Chopra & Sharma (1958), that the third division in each segment can be either periclinal or oblique anticlinal. This is followed by the standard pattern of alternating periclinal and anticlinal divisions observed in all other moss taxa. A three-layered amphithecium is formed in the region of the peristome. At the level of the annulus, a fourth layer is formed. At maturity, the IPL has eight cells, the PPL 16, and the OPL 32. Deposition of the peristomial thickenings takes place on the common wall between the IPL and the PPL, and forms the exostome teeth. The endostome segments are formed by thickenings on the periclinal wall between the IPL and the endothecium. Stone therefore described the PPL as the outer peristome layer in this moss. In this genus, as Stone pointed out, the exostome is homologous to the endostome of any other moss.

Deposition of Wall-thickening Material

The sources and locations of cell wall thickenings which form the peristome teeth have been debated for over a century (Ingold 1959, Schnepf et.al. 1978, Koponen 1982, Neumann 1983). Endostome thickenings were especially difficult for early workers to examine because, even at maturity, segments were extremely thin and membranous. Furthermore, confusion resulted from the erroneous assumption that the single row of teeth in the haplolepideous mosses was homologous to the exostome of diplolepideous mosses.

Lantzius-Beninga (1850) was the first to illustrate cross sections of mature peristome teeth. He described thickenings on the inner surface of the OPL, both surfaces of the PPL, and on the outer surface of the IPL. Sachs (1887) presented almost identical drawings showing thickenings on all four surfaces. Philibert (Taylor 1962), although presenting no illustrations, believed that all four surfaces were thickened, and that exostome and endostome teeth were similar in composition. Strasburger (1908) held a different view, explaining that the exostome is derived from the thickened outer wall of the PPL, while the endostome is derived from the thickened inner wall of the PPL.

The deposition of wall-thickening material, at the cellular level in *Brachythecium*, was examined in detail by Derschau (1900), who concluded that the thickenings of the endostome consist of only a single layer. The location of deposition can be predicted based on the position of the nucleus within the cell in which deposition will take place. In the case of the endostome, this will be on the outer walls of the IPL cells. Evans & Hooker (1913) also suggested a single layer of thickening in the IPL, but explained that it is the inner surface of the PPL which is thickened.

Several recent reviews of the subject (Anderson & Palmer 1982, Blomquist & Robertson 1941, Proskauer 1958, Kreulen 1972, Mueller 1973) all agreed that the peristomial thickenings in diplolepideous mosses take place only on the inner surface of the OPL, the outer surface of the PPL, and the outer surface of the IPL. No deposition takes place on the inner wall of the PPL. In haplolepideous mosses, deposition takes place on the inner surface of the PPL and on the outer surface of the IPL.

More recently, Shaw & Rohrer (1984) have reexamined the endostomes of 70 species of diplolepideous mosses with the SEM. Excepting *Funaria*, they tentatively suggest that the endostome teeth in the Bryales and Orthotrichales may be considered bilayered, if the primary wall of the PPL is included in the tooth. This would explain the absence of a vertical cell wall on the surface of the tooth. However, previous anatomists clearly recognized the fact that the primary wall of the PPL would be included in the endostome tooth, but only considered later secondary deposition in their analysis of wall thickening.

The Apical Cell and Its Derivatives

The presence of a single meristematic initial at the apex of the moss sporophyte has been known since the time of Hofmeister (1862). Numerous other early workers also described the presence of a single apical cell (Evans & Hooker 1913, Sachs 1887, Goebel 1905) including the early initiation of segments or derivatives. These have been termed "merophytes", and are defined by Gifford (1983) as: "immediate, unicellular derivatives of an apical cell and ... the multicellular structural units derived from them".

It has been suggested that perhaps the apical cell is quiescent (D'Amato 1975). However, Hébant (1973) confirmed that the apical cell initially does divide frequently, giving rise to segments early in sporophyte growth. Proximal to the uppermost 10 segments and immediately distal to the foot region, a "seta meristem" differentiates (Roth 1969). This intercallary meristem is responsible for the majority of seta cell divisions (French & Paolillo 1975, 1976). Therefore, the segments observed at the apex of a short seta are those which will differentiate into the peristome and operculum.

The sequence of cell divisions within a given segment has been described as extremely regular. Examining the shoot apices of liverworts, Schuster (1966) has shown that a precise series of cell divisions within each segment gives rise to leaves and lateral branches. Gunning, *et al.* (1978), and Chiang (1970), examined the roots of heterosporous ferns (*e.g. Azolla*) and reported precise patterns of cell division within segments, showing that cell position within a segment is responsible for differentiation. Based on location within a segment, cells will differentiate into xylem or phloem elements. Regular patterns of cell division and leaf initiation within segments of moss gametophytes have also been reported (Merl 1917, Berthier 1971-1972).

As noted above, previous workers have described part of the sequence in which divisions occur within any given segment in a moss sporophyte. The first division is anticlinal and divides the segment into equal halves. This is followed by a periclinal division, forming an inner and an outer cell, or by two anticlinal divisions, resulting in two amphithecial cells surrounding each endothecial cell. The remaining development within the segment is usually summarized as a series of alternating periclinal and anticlinal divisions, because often only cross sections of developing segments are considered. The lack of information about the sequence of divisions subsequent to the second plane of cell division, and its relation to segmentation, led Proskauer (1958) to state: "An examination of the illustrations of others, and of numerous serial sections, still leaves me in serious doubt about the actual relationship of the six layers (of amphithecium) in terms of segmentation of the apical cell".

Development of Cleistocarpous Capsules

Apical development of cleistocarpous capsules has also been described, although only in a limited number of taxa (Hofmeister 1862, Kienitz-Gerloff 1878, Muller 1868, Sachs 1887, Snider 1975, Rushing & Snider 1980, Schwartz 1989). Initial division planes within each segment are identical to those in taxa with peristomes, thus possibly allowing the assignment of these mosses to the correct peristome type, a prospect of considerable systematic importance.

Several early workers described the early segmentation of *Phascum* (Goebel 1905) and *Ephemerum* (Muller 1868), the latter being the most complete early study of this moss. Muller described the developing embryos and young sporophytes that he found attached to mature gametophytes. The early divisions of the apical cell, and divisions within the segments are illustrated and described in detail. However, in mid-development, the orientation of the sporophytes obviously differs among the various illustrations, and the segment boundaries are not discernable.

The earliest divisions within each segment of *Ephemerum* are identical to those found in taxa in the Funariales with well-developed peristomes (Schwartz 1989). This is apparently not the case for *Nanomitrium* (Goebel 1905). Aside from a basic description of segmentation, division within the segments is not discussed in his text. It appears from his illustrations that the vertical periclinal walls are formed before transverse division of the segment. Neither Muller nor Goebel described segmentation in either the later stages of development, or the differentiation of spores. Mature capsules of *Ephemerum* appear to have a well differentiated columella, and a capsule wall consisting of only a single layer of cells (Muller 1868). Muller does not describe a differentiated air space or spore sac around the sporogenous layers. Furthermore, no cross sectional views are discussed, so comparison of peristomial layers with those of other mosses is not possible. Goebel (1905) also does not present cross sections of *Nanomitrium*, and only describes those of *Phascum* and *Funaria*.

Another cleistocarpous genus, *Archidium*, has a developmental pattern which is apparently different from that of any other moss (Snider 1975). Like *Ephemerum*, the sporophyte of *Archidium* is greatly reduced, lacking a seta, peristome, and operculum. Unlike any other moss in the Funariales, *Archidium* also lacks both a columella, and a differentiated spore sac. In tracing the development of these capsules, Snider (1975) described the development in both cross and longitudinal section. An apical cell cuts off segments in two vertical files. Each of these segments divides in an oblique anticlinal plane, resulting in four cells being visible in cross section. It is at this point that the development differs from the fundamental square pattern of growth which has been observed for all mosses.

The next divisions of *Archidium* are anticlinal, resulting in two cells of unequal size. These divisions are followed immediately by formation of two short periclinal walls perpendicular to the preceeding walls. The results of these two divisions are two cells of endothecium surrounded by four cells of amphithecium. The next division is anticlinal and increases the number of amphithecial cells. This is immediately followed by two periclinal divisions of the amphithecium, resulting in the formation of a three layered amphithecium. Later, random divisions of the amphithecium in a radial plane result in a more typical appearance. Unfortunately, Snider provides no photographs to document his interpretation. Only drawings, which reflect the author's opinion, accompany this unusual description of development.

In longitudinal section, *Archidium* also differs greatly from all other mosses examined. Although segments are visible initially, the apical cell ceases dividing very early, and clear segment boundaries are not apparent in Snider's illustrations. The cells of the amphithecium form three distinct layers, which overarch the endothecium, and are continuous across the sporophyte apex. As in other mosses, e.g. *Funaria*, *Bryum*, *Physcomitrium*, the layers become continuous when the apical cell divides periclinally.

An air space forms later separating the capsule wall from the spore sac. Snider suggests that in *Archidium* the spore sac is derived from the endothecium. However, Stone (1988) correctly explained that this idea is in fact a misconception. The spore sac is continuous with the innermost layer of the amphithecium. As in other taxa examined, Stone reports that the IPL divides periclinally to form a two layered spore sac.

Although the earliest development of *Archidium* may differ greatly from that of other mosses, the cell division patterns of the amphithecium show some similarity. The orientation of the first four divisions seen in cross section differs from other mosses, but has similar effects in partitioning the amphithecium. After the third division, 6 cells of amphithecium surround the endothecium. Snider emphasizes that the "fundamental square" method of growth is not followed. Because the first anticlinal division of the segment is oblique rather than anticlinal, four distinct quadrants are not formed. However, beyond the first two divisions, an alternating series of anticlinal and periclinal divisions occurs external to the two endothecial cells.

As in *Funaria*, divisions become more random as maturity approaches. Snider's longitudinal sections show segmentation in the early embryos, but no segmentation in some of the later stages. This is probably due to differing orientations of the sporophytes. Most probably, early divisions of the segments are similar to those of other mosses except perhaps for the first anticlinal division. However, it is apparent that the reduced form of this sporophyte and the unusual spore differentiation (*i.e.*, not proceeding from a single layer) make comparison of the cell division patterns within the segment difficult. Stone's interpretation clearly shows that *Archidium* develops in a manner similar to other mosses. Without photographs and additional sections evaluation of this problem is difficult. Stone further explains that because the first divisions are not radial anticlinal, but oblique anticlinal, the sporophyte is bilaterally symmetric while other mosses are radially symmetric. However, because all mosses are formed by divisions of a two-sided apical cell, they are all necessarily bilaterally symmetric.

Development of *Lorenziella* has also been described as unique (Rushing & Snider 1980). Early development is identical to that of other mosses. A curved anticlinal wall is reported to separate the endothecium from the amphithecium. The amphithecial layers are formed by a series of alternating periclinal and anticlinal divisions. However, Rushing & Snider report that the fundamental square method of growth is not followed, and that a variable number of cells are found in the amphithecial layers. Other than this, development is similar to other moss taxa. For example, the PPL forms the filaments which transverse the air space in the proximal half of the capsule, while the IPL forms the spore sac. Similar to other mosses, *Lorentziella* has a six layer amphithecium at maturity.

I have studied the development of the peristomial region of the capsule in species of the eperistomate genera *Physcomitrium*, *Aphanorrhegma*, and *Ephemerum* (as well as the peristomate genera *Funaria*, *Splachnum*, and *Tetraplodon*; Schwartz 1989). Early patterns of cell division were found to be identical among all six genera, justifying assignment of all to the *Funaria* peristome type.

Much has been learned about peristome development and its systematic significance, yet much remains unstudied. The progress of research in this area has accelerated in recent years; it appears that a general comparative synthesis of peristomial homologies will eventually be possible.

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Table 1. Chronological summary of literature on peristome development.

Taxon	*Description*	*Authority*
Orthotrichum	Peristome teeth in multiples of four	Valentine (1835)
Polytrichum *Tetraplodon*	Peristome composed of cell wall remnants	Lantzius-Beninga (1850)
Funaria *Phascum*	Two-sided apical cell; early divisions within segments	Hofmeister (1862)
Ephemerum	Late capsule development, all longitudinal sections	Muller (1868)
Ceratodon *Funaria*	Alternate anticlinal and periclinal divisions; sporogenous layer outermost of the endothecium; segmentation	Kienitz-Gerloff (1878)
Andreaea *Sphagnum*	Sporogenous layer overarches columella	de Bary (1884)
Many taxa	Importance of peristomes in systematics; homology of peristomial layers	Philibert (1884, 1888)
Polytrichum *Funaria* *Archidium*	Maturation of capsule and peristomial layers	Sachs (1887)
Polytrichum	Early divisions of the peristomial layers	Vaisey (1888)
Polytrichum	Deposition of peristomial thickenings	Dershau (1900)
Ephemerum *Funaria* *Nanomitrium*	Discussion of periclinal vs. anticlinal divisions; detailed illustration of peristomial layers; illustration of cleistocarpus taxa	Goebel (1905)
Ephemerum *Funaria* *Phascum*	Brief description of cleistocarpus taxa; description of mid-development of *Funaria*	Campbell (1913)
Ceratodon	Haplolepidious mosses; divisions of amphithecium; division of peristomial layers	Evans & Hooker (1913)
Polytrichum	Development of the peristomial layers of nematodontous mosses	Van Der Wijk (1929) Lorch (1931) Wenderoth (1931)
Aulacomnium	Divisions of the peristomial layers; formation of 4:2:3 peristomial formula	Blomquist & Robertson (1941)
Funaria	Development of the peristomial layers	Smith (1955)
Pogonatum	Early divisions of the amphithecium, additional anticlinal division of amphithecial layers	Chopra & Sharma (1958)
Funaria	Re-analysis of the development of peristomial layers, and tooth deposition	Proskauer (1958)
Mittenia	Endothecium formed from the common wall of the IPL and the endothecium	Stone (1961)
Archidium	Development of the capsule peristomial layers	Snider (1975)
Lorentziella	Development of the capsule and peristomial layers	Rushing & Snider (1980)
Many taxa	Observations of endostomes of 70 species	Shaw & Rohrer (1984)

Taxon	*Description*	*Authority*
Orthotrichum	21 species of Orthotricaceae examined	Shaw (1986)
Hymenodon	Single row of teeth are actually an exostome	Shaw & Anderson (1986)
Diphyscium	Development shows a haplolepideous pattern with 4:2:3 formula	Shaw, Anderson & Mishler (1987)
Tetraphis	Development similar to arthrodontous species	Shaw & Anderson (1988)
Funaria *Bryum*	Comparison of development of these two peristome types	Shaw, Anderson & Mishler (1989)
Ditrichaceae Dicranaceaeeous	Development of haplolepid-peristomes	Shaw, Mishler & Anderson (1989)

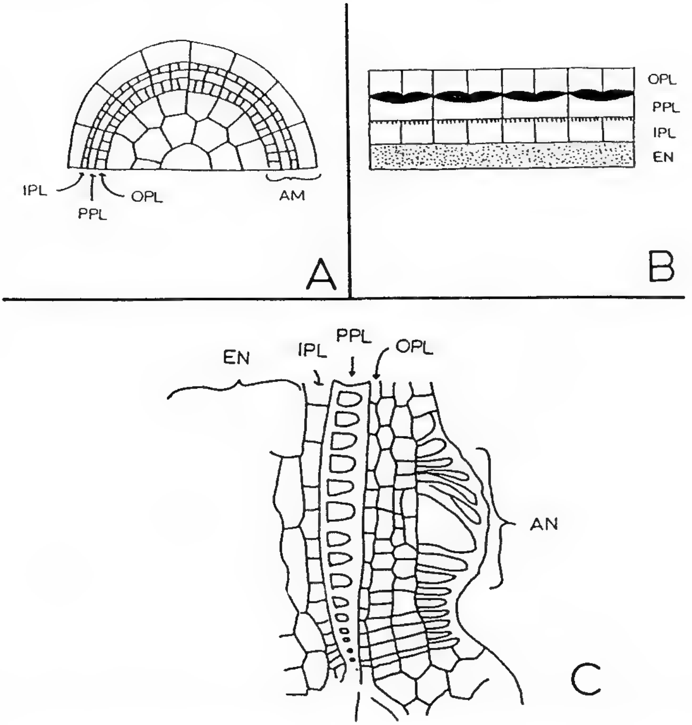

Figure 1. The positions of the peristome forming layers in the capsule of *Funaria*. **A)** A stylized cross section of a developing sporophyte. The peristome forming layers are the three innermost layers of the amphithecium (AM). In *Funaria* there are three additional amphithecial layers external to those which form the peristome. **B)** Positions of the wall-thickening material which forms the peristome teeth. The outer peristome teeth are formed from the common wall of the OPL and PPL, and are very thick. The inner peristome (endostome) is formed from thickenings deposited on the common wall of the IPL and PPL. These teeth are considerably thinner. **C)** A longitudinal section at the level of the annulus. The greatly enlarged annulus, as well as the peristomial layers are indicated. **AN** = Annulus, **EN** = Endothecium, **IPL** = Inner peristomial layer, **OPL** = Outer peristomial layer, **PPL** = Primary preistomial layer. A,C after Parihar (1956), B after Edwards (1979).

Additions to the Liverwort Flora of Naikoon Provincial Park, Queen Charlotte Islands, British Columbia, Canada

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The Queen Charlotte Islands lie in the Pacific Ocean 100 km west of the mainland coast of British Columbia and extend from 51° 54' - 54° 13' N to 130° 58' - 133° 06' W. The Islands consist of over 150 islands with many short inlets. The major islands are Graham (largest and most populous) and Moresby. The Naikoon Provincial Park covers an area of 72,640 hectares at the north-eastern corner of Graham Island and extends from 53° 11' - 53° 34' N to 131° 30' 132° 05' W (Fig. 1). The park faces Dixon Entrance (McIntyre Bay) to the north and Hecate Strait to the east. The southern boundary is the Tlell River. The Park consists mostly of the low, flat Argonaut Plain. The landscape was formed by deposits left from melt water originating from Wisconsinan glaciers.

Bogs are common and dominated by *Pinus contorta* (lodgepole pine), *Thuja plicata* (western red cedar) and *Chamaecyparis nootkatensis* (yellow cedar). However, *Tauga heterophylla* (western hemlock) and *Picea sitchensis* (sitka spruce) are abundant along the river valleys and at the higher elevations. Canning (1975) recognizes the following communities in the park, 1) maritime communities, including beaches, rock or cliff communities and salt marshes, 2) swamp communities, 3) mire communities, 4) raised bog communities, 5) coastal sand-dune forest communities, and 6) closed forest communities. The average January and August temperatures are 4° C and 17° C respectively. Precipitation, almost always in the form of rain, averages 140 cm annually in the park, but 560 cm along the west coast.

There are several studies of the vascular plants of park, but there is no study of the Hepaticae, although several species were mentioned from the area by Schofield (1968, 1975). The hepatic flora of the park is very rich, especially along the Cape Fife trail, Tow Hill and around the *Sphagnum* bogs.

The authors made collecting trips to the park during the summer months of 1988, 1989 and 1990. Approximately 700 collections of liverworts, including some from Pure Lake which is outside the park were made. In the list below, each taxon is followed by the number of specimens collected in an area. This gives a rough estimate of abundance in each of the 3 general collecting areas, i.e. **Cape Fife** (areas 1-5 and 11-14, north end of park in Fig. 1), **Mayer Lake** (6-8, southern end of the study area) and **Pure Lake** (9, central part of the study area).In general, nomenclature follows Stotler & Crandall-Stotler (1977) and Grolle (1983a, 1983b).

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List of Species

Bazzania ambigua (Lindenb.) Trov. - decayed wood and soil. Cape Fife, 11; Mayer Lake, 2; Pure Lake, 1.

B. denudata (Torr.) Trev. - decayed wood. Cape Fife. 26; Mayer Lake, 2.

B. tricrenata (Wahlenb.) Lindb. - decayed wood. Cape Fife, 4.

Blepharostoma trichophyllum (L.) Dum. subsp. *trichophyllum* - shaded, moist soil, rocks and decayed wood. Cape Fife, 24; Mayer Lake, 5; Pure Lake, 3.

Calypogeia azurea Stotler & Crotz - shaded, decayed wood and moist soil. Cape Fife, 6; Pure Lake, 1.

C. fissa (L.) Raddi - moist soil. Cape Fife, 1.

C. integristipula Staph. - shaded, decayed wood and moist loam. Cape Fife, 7; Mayer Lake, 1; Pure Lake, 1.

C. muelleriana (Schiffn.) K. Müll. - shaded, decayed wood and soil. Cape Fife, 10.

C, neesiana (Mass. & Carest.) K. Müll. - shaded, decayed wood. Cape Fife, 3.

C. sphagnicola (H. Arn. & J. Perss.) K. Müll. - shaded, decayed wood and moist soil. Cape Fife, 8; Mayer Lake, 11 Pure Lake, 1.

Cephalozia bicuspidata (L.) Dum. subsp. *lammersiana* (Hub.) Schust. - shaded, decayed wood, moist rocks and sandy stream banks. Cape Fife, 30; Mayer Lake, 5; Pure Lake, 3.

C. lunulifolia (Dum.) Dum. - shaded, decayed wood, wet rocks and stream banks. Cape Fife, 25; Pure Lake, 2.

C. macounii (Aust.) Aust. - decayed wood and moist soil. Cape Fife, 7; Mayer Lake, 4; Pure Lake, 2.

C. pleniceps (Aust.) Lindb. - shaded, decayed wood. Cape Fife, 2.

Cephaloziella divaricata (Sm.) Schiffn. - moist ledges. Pure Lake, 1.

Chiloscyphus polyanthos (L.) Corda - wet rocks. Cape Fife, 1.

Conocephalum conicum (L.) Underw. - moist soil and wet rocks. Cape Fife, 9.

Diplophyllum albicans (L.) Dum. - shaded, decayed wood, base of bark, soil and rocks. Cape Fife, 36; Mayer Lake, 6; Pure Lake, 1.

D. plicatum Lindb. - shaded, decayed wood and thin soil over rocks. Cape Fife, 13.

D. taxifolium (Wahlenb.) Dum. var. *taxifolium* - shaded, ledges and humus on rocks. Cape Fife, 1; Mayer Lake, 2.

Douinia ovata (Dicks.) Buch - shaded rocks and humus. Cape Fife, 2; Mayer Lake, 3; Pure Lake, 1. The margins of the leaves are more serrate than the typical form.

Frullania franciscana M.A. Howe - bark. Cape Fife, 5; Pure Lake, 1.

F. nisquallensis Sull. - branches and bark, dead wood and humus on rocks. Cape Fife, 16; Mayer Lake, 7; Pure Lake, 3.

Geocalyx graveolons (Schrad.) Nees - shaded, decayed vood, thin soil over rocks. Cape Fife, 1; Pure Lake, 1.

Gymnocolea inflata (Huds.) Dum. - wet rocks. Mayer Lake, 3; Pure Lake, 1.

Herbertus aduncus (Dicks.) S. Gray subsp. *aduncus* - bark of hemlock. Cape Fife, 2.

Jamesoniella autumnalis (DC.) Steph. - shaded, decayed wood and wet soil near streams. Mayer Lake, 2.

Kurzia sylvatica (Evans) Grolle - decayed wood and soil. Cape Fife, 7; Mayer Lake, 2; Pure Lake, 1.

Lepidozia reptans (L.) Dum. - shaded, decayed wood. Cape Fife, 14; Mayer Lake, 3; Pure Lake, 1.

Lophocolea bidentata (L.) Dum. - shaded, decaying wood and burnt stumps. Cape Fife, 11; Mayer Lake, 2.

Lophozia incisa (Schrad.) Dum. - shaded, decayed wood. Cape Fife, 9; Pure Lake, 3.

L. longiflora (Nees) Schiffn. - decayed wood and soil. Cape Fife, 2; Mayer Lake, 4.

L. ventricosa (Dicks.) Dum. var. *ventricosa* - shaded, decayed wood and ledges. Cape Fife, 1; Mayer Lake, 4.

Mylia anomala (Hook.) S. Gray - *Sphagnum* in peat bogs. Pure Lake, 1.

M. taylori (Hook.) S. Gray - shaded, decayed wood and moist soil. Cape Fifeg 18; Mayer Lake, 5; Pure Lake, 1.

Pellia endiviifolia (Dicks.) Dum. - wet rocks and soil near streams. Cape Fife, 6; Pure Lake, 1.

P. epiphylla (L.) Corda - moist soil near streams. Cape Fife, 1; Mayer Lake, 4.

P. neesiana (Gotte) Limpr. - moist soil near streams. Cape Fife, 2; Mayer Lake, 1.

Plagiochila asplenioides (L.) Dum. -moist soil and decayed wood. Cape Fife, 4; Mayer Lake, 1.

P. porelloides (Torr.) Lindenb. - wet rocks and soil near streams. Cape Fife, 10.

P. satoi Hatt. - shaded bark. Cape Fife, 1.

Pleurozia purpurea Lindb. - moist soil. Cape Fife, 1.

Porella cordaeana (Hub.) Moore - rock outcrops near streams. Mayer Lake, 1.

P. nvaicularis (Lehm & Lindenb.) Lindb. - bark, decayed wood and humus on rocks. Cape Fife, 17; Mayer Lake, 3.

Ptilidium pulcherrimum (G. Web.) Hampe - decayed wood. Mayer Lake, 1.

Radula bolanderi Gott. - bark. Cape Fife, 5; Mayer Lake, 2.

R. complanata (L.) Dum. - bark. Cape Fife, 1.

R. obtusiloba Steph. subsp. *polyclada* (Evans) Hatt. - wet rocks. Cape Fife, 1.

Riccardia latifrons Lindb. - shaded, wet decayed wood. Cape Fife, 7; Mayer Lake, 4.

R. palmata (Hedw.) Carruth. - shaded, decayed wood. Cape Fife, 17; Mayer Lake, 3; Pure Lake, 3.

Scapania bolanderi Aust. - bark, decayed wood and soil. Cape Fife, 52; Mayer Lake, 13; Pure Lake, 5.

S. umbrosa (Schrad.) Dum. - shaded, decayed wood and wet soil near streams. Cape Fife, 7; Mayer Lake, 3.

S. undulata (L.) Dum. var. *undulata* - shaded, decayed wood and wet soil near streams. Cape Fife, 1; Mayer Lake, 2.

Voucher specimens have been deposited at the College of Great Falls, Montana (GFC), with available duplicates in the herbarium of the University of Cincinnati (CINC) and British Columbia Provincial Museum of Victoria, British Columbia, Canada (V).

Acknowledgements. The senior author thanks President W. Shields, Dean T. O'Hare, Chairman E. Peressini and Sister M. Benoit for their assistance. We are also grateful to District Manager H.J. Markides and J. Hopkins at Northern B.C. Regional Office, Ministry of Parks for the permission to collect; and to Mr. & Mrs. Bellis, Bellis Lodge for providing lodging facilities. Finally the senior author thanks Dr. D. Vitt for suggestions after reading the manuscript.

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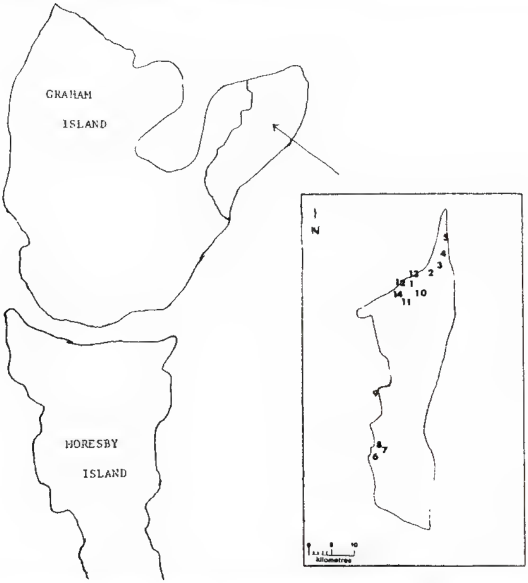

Figure 1. Naikoon Provincial Park, Canada collecting localities. 1. Entrance of Cape Fife Trail. 2. Cape Fife Trail. 3. *Sphagnum* bog, Cape Fife Trail. 4. End of Cape Fife Trail. 5. Fife Point. 6. Entrance of Mayer Lake. 7. Mayer Lake. 8. Stream into Mayer Lake. 9. Pure Lake. 10. River Trail. 11. Swan Creek. 12. East Beach Trail of Tow Hill. 13. South Beach of Tour Hill. 14. Tow Hill.

The Distribution of North American Bryophytes *Orthotrichum rupestre* Schwaegr.

Dale H. Vitt[1]

In North America there are 36 species of *Orthotrichum* north of Mexico. The Mexican flora has four additional species, bringing the total number of species on the continent to 40. The genus is characterized by acrocarpic plants that generally have numerous sub-apical branches. Almost always, the leaves have revolute margins and lack hyaline awns. The upper leaf cells have conical or forked papillae and the basal cells are smooth. The capsules are 8-ribbed or smooth; immersed, emergent or shortly exserted; and possess a diplolepideous peristome that is either double, single or rarely absent. The calyptrae are large, mitrate, and plicate, often with straight hairs (thus the name of the genus). The species occur on tree trunks and (more rarely) on branches and on calcareous and acidic rock surfaces.

Orthotrichum rupestre is a species of acidic or neutral cliff faces. It is most common in montane, coniferous forests dominated by such trees as *Pseudotsuga menziesii*, *Pinus contorta*, *Picea glauca*, *Picea pungens*, and *Abies lasiocarpa*. This species has superficial stomates, a rich green color, relatively large plants, and basal leaf cells that are relatively long and have irregularly thickened walls. The basal cell character correlates nicely with superficial stomates (Vitt 1973) . The capsules are oblong, smooth or lightly 8-ribbed and emergent, have a single peristome consisting of 16 somewhat reduced, but erect (when dry) exostome teeth. The calyptrae are densely hairy with the hairs flexuose-erect and papillose. It often occurs with *O. laevigatum* that has cylindric, shortly exserted, smooth capsules. From species such as *O. hallii*, *O. pellucidum*, and *O. anomalum* that grow on dry, generally calcareous rock faces and possess capsules with immersed stomates, *O. rupestre* is a larger species having a richer green color and more sharply pointed leaves. The nodose basal cells of *O. rupestre* are generally distinctive when compared to the straight, uniformly thickened walls of the basal cells of the species having immersed stomates. In difficult cases, I have found that the flexuose, distinctly papillose calyptra hairs differentiate *O. rupestre* from *O. laevigatum* (and *O. speciosum* and *O. pylaisii*) that have less hairy calyptrae with straight hairs and less obvious papillae. When sterile, *O. rupestre* cannot be distinguished with certainty from other species with superficial stomates. See Vitt (1973) for further information.

In North America, *O. rupestre* is one of the most common members of the genus in the montane forests of the western portion of the continent. There it occurs from southern Alaska and the Yukon Territory, south through British Columbia and

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Alberta, California, Arizona, and New Mexico, to two stations in Baha California Norte. It is common in California east to the Black Hills, South Dakota and Colorado. Disjunct at two boreal forest stations in Alberta. Specimens have been verified from four widely disjunct localities in eastern North America. On phytogeographic grounds, Vitt (1973) questioned whether the specimens from the White Mountains, New Hampshire (MICH); Clyde Inlet, Baffin Island (NY); and Newfoundland (NY, with no further information) were actually from the localities as cited on the labels (open circles on the distribution map). I felt at the time that further collections were needed from these locations for the species to be included in the flora of eastern North America. In 1974, three specimens from the Isle Royale area were verified (one from Fort William, Ontario, one from Cook Co., Minnesota, and one from Isle Royale, Michigan). As a result of these specimens it was hard to deny that the species occurred in the east. However the three remaining localities in the east have yet to be verified. Since 1973, when I originally mapped this species, the known range in western North America has been expanded into northwestern Mexico, northern British Columbia, and central Montana. Lewinsky (1977) has recently recorded the species from southernmost Greenland. Other publications that discuss aspects of the taxonomy or distribution of *O. rupestre* are those by Jette Lewinsky in 1978a, 1978b, 1983, 1984 and 1987.

New Records: *Seligeria donniana* (Sm.) C. Muell. NEW TO SASKATCHEWAN! Derik Johnson (Forestry Canada, Edmonton Alberta) has sent me a specimen of this species that significantly extends its recorded range into central Canada. This is the only collection known between northern Michigan and the eastern foothills of Alberta and is also the only specimen known from the boreal forest region of Canada. Specimen verified: CANADA. SASKATCHEWAN: East of Highway 167, north of Meridian Creek, 54°32'N, 102°07'W, 303 m. elevation, on limestone cliff. *D. Johnson 7286* (CAFB). Additional reports, new collections and range extensions should be sent to the author. These findings can be reported in the future editions of this series.

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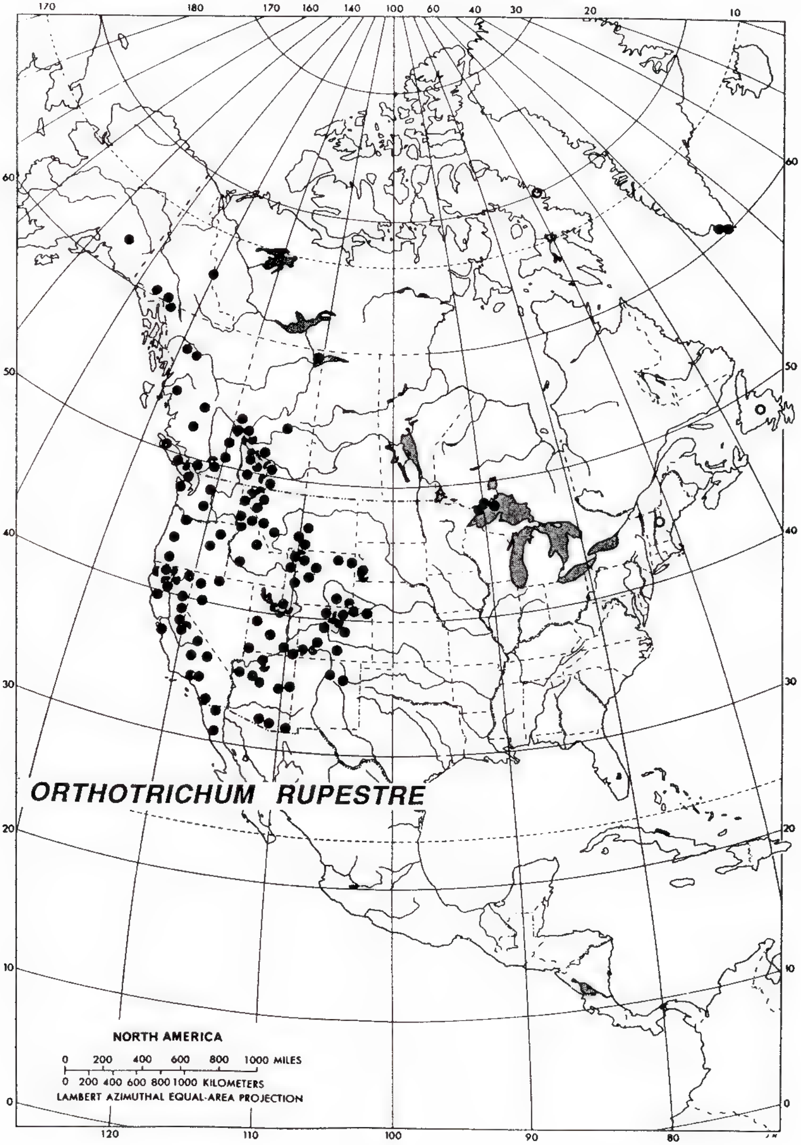
ORTHOTRICHUM RUPESTRE
NORTH AMERICA
0 200 400 600 800 1000 MILES
0 200 400 600 800 1000 KILOMETERS
LAMBERT AZIMUTHAL EQUAL-AREA PROJECTION
170
180
170
160
140
100
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80

Notes on Mniaceae from the Cochrane District, Ontario, Canada

Ann Stoneburner and Robert Wyatt[1]

Intensive sampling of live material from populations of Mniaceae in northern Ontario in 1989 uncovered several species not previously reported from this region by Ireland & Cain (1975) in their "Checklist of the Mosses of Ontario." Our collecting was concentrated in the vicinity of Moosonee (51° 30'N, 80°63'W), a small town in the Cochrane District located at the mouth of the Moose River, where it flows into James Bay (the southern extension of Hudson Bay). The poorly drained, flat terrain (elevation = 5 m above mean sea level) is dominated by depauperate boreal forest and peatlands.

Among the species we sampled was *Rhizomnium appalachianum*, which occurs commonly farther south but has not been reported previously from the Cochrane District (Ireland & Cain 1975). This large, well-marked species grew with *Sphagnum* in very wet, flat depressions with standing water beneath a canopy of black spruce (*Picea mariana* (Mill.) BSP.) and American larch (*Larix laricina* (DuRoi) K. Koch). Koponen's (1973a) distribution map for *R. appalachianum* also shows no sites in Ontario within 400 km of Hudson Bay and only one site (in Newfoundland) north of 50°. It is likely, however, that this species occurs abundantly in the intervening boreal forest regions and has simply been overlooked (see Stoneburner and Wyatt's (1989) discussion of the taxonomic confusion surrounding this species and its close relatives).

We also collected numerous population samples of *R. gracile*, previously noted by Ireland & Cain (1975) as occurring only in the Algoma District near Lake Superior, a report that was based on a misidentification (R. R. Ireland, personal communication). These very small plants were common in the Moosonee area, occurring abundantly on disturbed peat lining the walls of depressions in thinly wooded spruce-larch-alder (*Alnus rugosa* (DuRoi) Spreng.) forest. This site is well within the expected range of *R. gracile*, and Koponen's (1973a) distribution map includes Moosonee. We also collected *R. pseudopunctatum*, which often occurred in the same depressions as *R. gracile* but higher on the walls. This bisexual species frequently was observed with abundant sporophytes. Its range has been mapped most recently by Stoneburner & Wyatt (1989).

Ireland & Cain (1975) recorded *Cinclidium stygium* only from the Kenora and Thunder Bay Districts of Ontario, well south of Moosonee. The species, however, should be expected farther north, as it is primarily arctic in its overall distribution (Mogensen, 1973). The plants formed large, healthy mats on bare peaty soil in the

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bottoms of wet depressions in moist spruce-larch-alder forest. Ontario should be added to Koponen's (1973b) list of provinces in which *C. stygium* occurs. We also observed in these areas *Pseudobryum cinclidioides*, which Ireland & Cain (1975) listed for Thunder Bay but not for the Cochrane District. Of the species in *Plagiomnium* Section *Rosulata*, we observed *Plagiomnium ciliare*, *P. medium*, and *P. ellipticum* (Brid.) Kop., all but the latter previously unreported from the Cochrane District (Ireland & Cain 1975). Like *Rhizomnium appalachianum*, *P. ciliare* is a more southern species that extends its range northward to James Bay (Koponen, 1971), where it occurs in drier mixed conifer-hardwood forest. Colonies at this latitude seem much less well-developed than those from the eastern deciduous forest farther south. Both *P. medium* and *P. ellipticum* are circumboreal species (Koponen, 1971). Near Moosonee the colonies of *P. ellipticum* in wet alder thickets were especially large and frequently bore sporophytes. Some plants from these areas were characterized by leaf margins with unexpectedly long, up to three-celled teeth that mimicked the appearance of leaves of typical *P. ciliare*. We also found *P. rostratum* and *P. cuspidatum* (Hedw.) Kop. on humus at tree bases in more upland sites.

Our discovery of range extensions for many of these taxa is not surprising, given the lack of collecting in much of northern Ontario, largely because of its inaccessibility. As Ireland & Cain (1975) noted for all of Ontario: "bryological exploration in any of these four regions [deciduous forest, Great Lakes forest, boreal forest, and tundra] should yield a number of new records." R. R. Ireland and L. Ley are currently preparing an atlas of the mosses of Ontario. Their collections will extend the known ranges of many taxa of Mniaceae northward; most notably, they have obtained specimens of *Cinclidium stygium* and *Pseudobryum cinclidioides* from the northernmost regions of the Cochrane District.

Specimens cited. Voucher specimens of all our collections are deposited in CANM.

Rhizomnium appalachianum. Canada. Cochrane District. Off Pisew Road, about 3.2 km SSW of Moosonee. On very wet peat in depressions beneath spruce and larch, Stoneburner & Wyatt 5106.

Rhizomnium pseudopunctatum. Canada. Cochrane District, loc. cit. On wet peat and edges of depressions in wet spruce-larch-alder forest, Stoneburner & Wyatt 5105.

Rhizomnium gracile. Canada. Cochrane District, loc. cit. On disturbed peaty soil in wet spruce-larch-alder forest, Stoneburner & Wyatt 5104a. Moose Factory Island, about 3.2 km NE of the dock. On the sides of wet depressions in moist spruce-larch-alder forest, Stoneburner & Wyatt 5108. Off Tacan Road, about 1.5 km W of Moosonee Airport. On disturbed peat on sides and bottoms of depressions in spruce-larch-balsam poplar forest, Stoneburner & Wyatt 5112. Wooded area just W of the Ontario Northland Railway Station in Moosonee. On disturbed peat in depressions under spruce-larch-alder forest, Stoneburner & Wyatt 5114.

Cinclidium stygium. Canada. Cochrane District. Moose Factory Island, about 3.2 km NE of the dock. On bare peaty soil in the bottoms of wet depressions in moist spruce-larch-alder forest, Stoneburner & Wyatt 5109.

Plagiomnium ciliare. Canada. Cochrane District. Moose Factory Island, about 8 km NNE of the dock. Among grasses and sedges along trail through alder thicket, Stoneburner & Wyatt 5107a. Charles Island, Tidewater Provincial Park. On decorticated logs and humus at tree bases in mixed conifer-hardwood forest, Stoneburner & Wyatt 5113a. Wooded area W. of railroad bridge over Store Creek in Moosonee. On soil and humus in *Alnus* carr, Stoneburner & Wyatt 5115c.

Plagiomnium ellipticum. Canada. Cochrane District. Moose Factory Island, about 8 km NNE of the dock. Among grasses and sedges along trail through alder thicket, Stoneburner & Wyatt 5107c. Butler Creek, off Tacan Road, about 2 km W of Moosonee Airport. On soil in *Alnus* carr with scattered balsam poplar, Stoneburner & Wyatt 5110. Off Tacan Road, about 1.5 km W of Moosonee Airport. On soil beneath alder thicket along ditch paralleling road, Stoneburner & Wyatt 5111. Wooded area W of railroad bridge over Store Creek in Moosonee. On soil and humus in *Alnus* carr with scattered spruce and balsam poplar, Stoneburner & Wyatt 5115a.

Plagiomnium medium. Canada. Cochrane District. Moose Factory Island, about 8 km NNE of the dock. Among grasses and sedges along trail through alder thicket, Stoneburner & Wyatt 5107b. Wooded area W. of railroad bridge over Store Creek in Moosonee. On soil and humus in *Alnus* carr, Stoneburner & Wyatt 5115b.

Plagiomnium cuspidatum. Canada. Cochrane District. Charles Island, Tidewater Provincial Park. On humus at tree bases, Stoneburner & Wyatt 5113b.

Acknowledgments We thank T. Koponen and R. R. Ireland for advice on collecting sites, W. Hutchinson and D. Hagen for logistical support, and D. Grisé and I. J. Odrzykoski for specimen processing and discussion. R. R. Ireland read an earlier draft of the manuscript and made available to us the maps of Mniaceae from his and L. Ley's forthcoming atlas of the mosses of Ontario. We also thank the National Science Foundation for a grant in support of our work on the Mniaceae (BSR-8806386).

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For additional information and the second circular contact The New York Natural History Conference, Rm 3132 C.E.C. Biological Survey, New York State Museum, Albany, NT 12230.

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An immediate opening for a bryologist interested in comparative analysis of rRNA gene sequences and the phylogeny of green algae and bryophytes is available at LSU. The position is open to a bryologist interested in phycology and DNA sequencing. Molecular training will be provided to the successful applicant if needed.

The molecular systematics group at LSU may have additional Post-Docts available this fall for those interested in furthering their training and research in this area.

LSU also provides special graduate fellowships, available for highly qualified PhD students, and is interested in talking to bryophyte-oriented PhD students interested in joining the molecular systematics group at LSU.

For further details contact Dr. Russ Chapman, Professor and Chair, Department of Botany at LSU, Baton Rouge, LA 70803-1705.

Systematics and Evolution of Mosses: A Symposium* in Honor of Dr. Lewis E. Anderson's 80th Birthday

June 5 - 7, 1992

Duke University

Durham, NC

All bryologists, students, colleagues, and friends of Dr. Anderson are invited to attend a meeting this June that will combine formal scientific talks, informal discussions, a field trip, and unforgettable social events.

The plan is for people to arrive on Friday, June 5. Friday afternoon there will be an open house in the Duke bryological laboratories and herbarium; in the evening there will be a reception. Saturday morning there will be a scientific session with invited talks by some of Dr. Anderson's associates on general topics of moss systematics and evolution. In the afternoon there will be time for contributed papers or posters and possibly some discussion groups. Saturday evening will feature a gala dinner, followed by a roast in honor of Dr. Anderson, featuring some of his closest (and most candid) colleagues. Sunday, there will be an all-day field trip to the coastal plain, returning to Durham in the evening, probably after dinner (so Monday morning would be the best time to depart, although we hope folks will attend even if they have to skip the fieldtrip). You are welcome to spend more time in Durham for research purposes.

Raleigh-Durham International Airport (RDU) is an American Airlines hub, so there should be no trouble finding convenient, relatively inexpensive flights (especially staying over Saturday night and booking ahead). Given the varied tastes (and pocketbooks) of different people, it would be best if everyone made their own lodging arrangements; several hotels are close to campus, with a considerable gradient in cost. Our favorite local travel agent is McDonald Travel: (919) 286-7456 or (800) 334-8352. We will attempt to house visiting graduate students in homes. A modest registration fee will be set later, as will the price of a banquet ticket.

☞ **All interested parties should contact Brent Mishler at (919) 684-3715; Dept. of Botany, Duke University, Durham, NC 27706, as soon as possible, at least by December 1, 1991. We need to know how many will attend, and who would like to present a contributed paper or poster.**

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*sym•po•sium *n, pl* sym•po•sia [L, fr. Gk *symposion* to drink together, fr. *syn* - + *pinein* to drink] 1 a : a drinking party esp. following a banquet b : a social gathering at which there is a free interchange of ideas 2 a : a meeting at which several speakers deliver short addresses on a topic or on related topics b : a collection of opinions on a subject c: discussion (Websters New Collegiate Dictionary)

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The Missouri Botanical Garden's new IBM RISC 6000 computer was recently connected to the internet. We are currently exploring the opportunities this communications option provides to our staff and ways to provide better access to the Garden's data bases to other scientists connected to the networks.

One spinoff from this effort is that I now have on-line, direct access to e-mail over the internet. The new address is: **magill@mobot.org**

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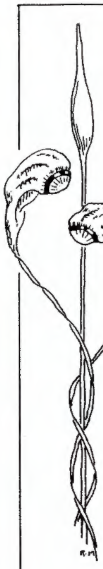

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